SEP 17 1923

TELEPHONE ENGINEER

VOLUME 27 SEPTEMBER, 1923 Number 9

Strowger Automatic for the World's Largest City

The adaptability of Strowger Automatic Telephone Equipment to the traffic and service needs of exchanges of every size, from the smallest community exchange to the largest city network, has been demonstrated by more than thirty years of experience in actual operation.

A most gratifying recognition of this fact is the recent decision of the British Post Office to adopt Strowger Automatic Equipment for the London network of more than ninety exchanges.

Automatic Electric Company

FACTORY AND GENERAL OFFICES: CHICAGO, ILLINOIS

BRANCH OFFICES IN ALL PRINCIPAL CITIES

ASSOCIATED COMPANIES

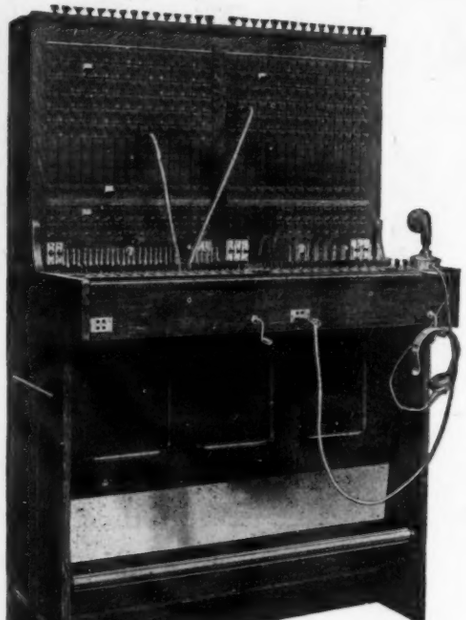
INTERNATIONAL TELEPHONE SALES AND ENGINEERING CORPORATION, New York

International Automatic Telephone Company, Ltd., London

Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, Paris

Automatic Telephone Mfg. Co., Ltd., Liverpool

Automatic Telephones, Australasia, Ltd., Sydney



No. 25—300 LINES

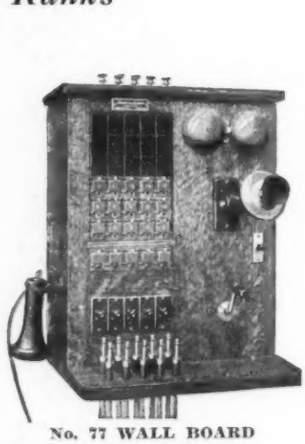
Burns Express SWITCHBOARDS

Built by a factory with over 30 years' experience in the manufacture of high grade telephone apparatus.

Supplied in all the popular sizes and styles. Will give continuous, satisfactory, efficient and economical service. Unit type of drop and jack means simplicity of mechanism and long life.

The Test of Service Has Placed Burns Express Switchboards in the Front Ranks

Several exclusive features in design. Most up-to-date type of construction. Adaptable to exchanges of any size. More equipment easily added as the exchange grows.



No. 77 WALL BOARD
For the Small Exchange

RADIO

We can supply you with your Radio head receivers. Ask about our several different types. Furnished in various resistances, highly sensitive. Also Radio Jacks, Plugs, Cords, etc.

Full data and prices gladly given. Tell us of your proposed purchases of both telephone and switchboard equipment.

American Electric Company

State and 64th Street, Chicago, U. S. A.

A stock of our standard equipment is carried in stock in your territory

TELEPHONE ENGINEER, September, 1923, Volume 27, No. 9. Published monthly by TELEPHONE ENGINEER. Publication office, 28 E. Jackson Blvd., Chicago, Ill. Subscription price $2 a year in the U. S. Entered as second class matter June 6, 1922, at the Post Office at Chicago, Ill., under act of March 3, 1879.

GENERAL OFFICES:
28 E. JACKSON BLVD.
CHICAGO, ILL.
Tel. Harrison 4000

TELEPHONE ENGINEER

EASTERN OFFICES:
56 W. 45TH ST.
NEW YORK
Tel. Vanderbilt 3695

VOLUME 27 SEPTEMBER, 1923 Number 9

SUGGESTING A STANDARD REPORT FORM

The action of the Interstate Commerce Commission in changing the classification of telephone companies and in relieving companies having less than $50,000 annual revenue from a special report is welcomed by all telephone companies. The commission will accept from these companies a copy of the report that the company must file with its local regulating body. This suggests the thought that the annual report to the State regulatory body might be made the basis for a number of reports that are now made to various state bodies. Why not a modified report made to the utilities commission which would include information for all commissions? What State Association will take up the suggestion, make a study of it and see if it is practicable?

ARE LIFE INSURANCE PREMIUMS OPERATING EXPENSE?

In a case before one of the Public Service Commissions recently, the Commission was called upon to decide whether the premium on an insurance policy on the life of the manager, and made payable to the company on his death, was a proper operating has come to our attention where charge. This is the first case that by a telephone company, although similar policies have been taken out in some other lines of business. The Commission's decision in this case was that the premium was not properly chargeable as operating expense as the policy was for the benefit of the stockholders rather than for the public.

USING THE TECHNICAL PAPER

How many telephone companies subscribe for a telephone paper for their employes? How many managers receive the telephone papers and, after they are read, pass them on to others of the company? We are afraid that there are not as many doing this as should be. One company subscribed for a copy for each of its exchanges. Another rather larger company subscribes for two copies; one for the manager's personal use, the other for the department supervisors. A slip is pasted to the cover of the second copy giving the names of those who are to see it. It is then sent around, each person checking off his name when he has finished and passing it on to the next. One or the other of these practices, depending upon local conditions, could be adopted by other companies with profit to themselves and to their employees.

TELEPHONE ENGINEER
Vol. 27 September
No. 9 1923
Entered as second-class matter. June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879.

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SUBSCRIPTIONS
The subscription price of TELEPHONE ENGINEER is $2 a year in the United States, Cuba and Mexico; in Canada it is $5; in all other countries $4. Single copies, U. S. A. 20 cents.

ADVERTISING
TELEPHONE ENGINEER is issued the 15th of each month. Copy can be accepted as late as the 8th of the month preceding date of publication. Where proof must be seen, allow ample time for transmission in the mails. Display Advertising — Rates on application. Classified Advertising—"Wants," "For Sales," etc.—$3 an inch, or 6 cents a word per insertion.

PUBLIC OWNERSHIP BECOMING A FACT

Strange as it may seem, public ownership of the utility enterprises of the United States is fast becoming a reality. This is happening, not through government ownership as advocated by a certain class of brilliant but superficial editorial writers or by slippery politicians. It is coming through the investment of the savings of literally millions of citizens.

The public has come to realize that utility securities offer a safe and conservative investment, and there are thousands of new "customer owners" being added monthly. Likewise, the utilities have found that their best interests are conserved when they take the public into partnership.

This type of public ownership serves to promote thrift; it builds up a group of users of service who are actively interested in the welfare of the utility, and it leaves the management in private hands where personal energy, initiative and inventive ability may find a reward that can never be realized under the soporific routine of official control.

TELEPHONE ASSOCIATION PARASITES

When the manager of a certain telephone company was approached by the secretary of his state telephone association to take out a membership for his company, his answer was somewhat as follows: "We do not have to join the association. You fellows over at the State Capitol go on working just the same and we get the benefits, even if we do not join."

Unfortunately, there are many independent (please note the ab-

sence of the capital letter) managers who have the same attitude toward their associations as this one. Every state association secretary can tell stories of managers who come in for advice, for assistance in hearings before public service commissions or representation in tax matters. For a small fee, they join the association and receive services that would cost several times as much if they were to employ outside attorneys, engineers or accountants. After they have received the service and the particular matter is cleared up, no more is heard from them. They become delinquent and are dropped from the records, only to reappear when again in trouble.

This situation is one of the discouraging features of association work. If every telephone company took this selfish and short-sighted position, the state associations would speedily disappear and the industry would be left unrepresented in legislative matters and in matters that affect the business as a whole in its relations with the various governing bodies of the state. Most states are fortunate enough to have a group of faithful companies who give their continuous assistance and who, for their own benefit and for the welfare of their fellow companies, are willing to share the added burden that is placed upon them, because there are a few who will take all and give nothing.

THE VALUE OF PUBLICITY

When Mr. Jack Dempsey of Somewhere - in - the - West (and Hog Island) and Señor Luis Angel Firpo, who left his place as a footwear fitter, or was it drug dispenser, in the metropolis of the Southern Hemisphere, began to negotiate for the opportunity of pummelling each other until the referee could count out one or the other, the newspapers began to contribute untold thousands of dollars' worth of space as free advertising.

Day by day after the training season began the public was regaled with tales of how these eminent battlers were spending their efforts in pushing the faces of ambitious and long-suffering sparring partners. Daily hundreds of devotees laid down their four or six-bits for a privilege of a peep at their idols.

Finally, when the day of battle arrives, some hundred thousand lay down treasured notes from the U. S. Bureau of Engraving and Printing in exchange for the right to occupy a bare-board seat in a smoke-filled arena. Several other hundreds of thousands gather around newspaper bulletin boards, tickers and radio sets to hear the results, punch by punch.

What is the cause of all this interest? Publicity, of course. The newspapers have donated free advertising and in return have sold a few thousand extras at so many pennies apiece.

When a telephone company spends three millions of dollars for a new machine-switching central office in the downtown district of a large city, do the newspapers carry, day by day, stories of the work of the engineers in planning, of the men of the factory in assembling and installing, and of the careful preparations for the cut-over? They do not. Perhaps a column, the morning after, tells how the mayor dialed the first number and congratulated the president of the company upon the improvement. No crowd gathers to see the cut-over and no radio station broadcasts the news.

If memory serves aright, it was Mr. Dooley who said: "If Casey goes to confession of a Saturday night and to church on Sunday morning, it don't get into the papers; but if he should go home drunk and beat up his wife and get pinched it would be in all of the papers. That'd be news." The newspapers are not to be blamed. They must print the news that the public will read. Yet, sometimes we think that the public in this age has queer tastes when it comes to news.

PIKE COUNTY PROFIT-SHARING PLAN

One of the acute problems in the telephone field is the maintenance of an adequate staff of trained employes for the proper construction, operation and maintenance of the plant. Not only must the efficient workers who are now in the industry be retained, but the opportunities must be made sufficiently attractive that there is a continuous flow of new people into the business to replace those who must retire from age, disability or other reasons. An adequate wage must be paid and other attractive features of employment must be provided. Sickness and disability benefits, old-age pensions, stock ownership by employes and vacations with pay have been made a part of the plan of employe benefits of the Bell system, and many Independents have adopted similar plans. Extensions of these plans are now being proposed by other companies.

A plan that has found some application in the manufacturing industries, but which has not been tried to any considerable extent in the utility field, is the bonus or profit-sharing plan. It was with considerable interest that we learned of a plan put into effect by the Pike County Telephone Co., of Pittsfield, Ill., of which Ed. D. Glandon is general manager. At the first opportunity a Staff Correspondent visited Mr. Glandon's company, and in this issue of TELEPHONE ENGINEER we tell the story of his plan and its application.

The experience with this plan by the Pike County Telephone Co. indicates that it is well worthy of consideration by other companies with similar problems to meet.

Lumpkin Heads Buyers of Kewanee Company

Kewanee, Ill.—W. C. Lumpkin of Mattoon heads the company which has purchased the property of the Kewanee Home Telephone Co. from Pennsylvania interests.

Strength of Telephone Poles

An Article Written from a Practical Engineering Viewpoint to Show the Factors Which Affect Pole Line Strength; Also, to Indicate the Proper Method of Calculating Stresses

By J. M. Walshe

The matter of the strength of telephone pole lines is one of great importance to every person who uses the telephone, for upon the pole line are strung the majority of long distance and, except in cities, a large portion of the local lines.

There are several ways to augment the strength of telephone pole lines, for example: (1) to use poles of a larger diameter; (2) to increase the number per mile; (3) to use "H" poles; (4) to use "A" poles; (5) to brace poles; (6) to side guy; (7) to anchor guy; (8) to use stronger material than wood, such as steel or reinforced concrete.

With all these, it is still the strength of the pole itself that is the matter of most importance. When the probable performance of the poles has been calculated for the specified conditions, no danger is to be anticipated of their failure. Adequate pole inspection is, of course, assumed.

Some methods of calculating the strength of wooden poles and the stresses to which they are subject are given here.

Tables Showing Various Strengths of Poles

The resistance of a pole to loads acting in the direction of its axis depends on three conditions: First, on the proportion which its least transverse dimension bears to its length; second, on the form in which the pressure is applied to the ends; third, on the direction in which the load acts with reference to the axis of the pole. The ultimate strength of poles is given in the following Table I:

Table I

When 12 diameters long, the strength is 5/6 crushing load of short lengths.

When 24 diameters long, the strength is ½ crushing load of short lengths.

When 36 diameters long, the strength is 1/3 crushing load of short lengths.

When 48 diameters long, the strength is 1/6 crushing load of short lengths.

When 60 diameters long, the strength is 1/12 crushing load of short lengths.

When 72 diameters long, the strength is 1/24 crushing load of short lengths.

To find the crushing load, it is necessary to find the crushing load of short lengths, which fail from compression alone. This varies with the kind of wood, and from various sources the following data in Table II have been taken, showing the ultimate strength of short lengths of timber to compression:

Table II

	Lbs. Per Sq. In.
Fir	5,600
Larch	3,300
Pitch Pine	6,700 to 6,000
Oak	7,800 to 10,000
Ash	9,000 to 9,300

Strength of Poles Under Compression

There are several formulae for the strength of a pole subject to compression only. The effective length is the length from the ground to the point of application of the pressure and is 21 ft. in a 30-ft. pole with four crossarms, set 5 ft. 6 in. in the ground. The mean diameter is taken and one a 30-ft. pole with 7-in. top is 9½ in.

Taking the lowest compression strength, 3,300 lbs. per sq. in. and the area of the mean diameter, 9½ in., to equal 29.75 sq. in., multiply these together, getting 98,600.

The table tells us that for such a pole 27 diameters long, the ultimate strength will be only 11/24 of 98,600, which is 45,188 lbs. The factor 11/24 does not appear in the tables, so it is calculated as follows:

30 is the mean between 24 and 36; the mean between and ½ and 1/3 is 5/12; then, taking the mean of 24 and 30 as 27, the mean of ½ and 5/12 is 11/24.

This figure 45,188 lbs. is for downward pressure only. I will not appear excessive if the pole line is to be of a more permanent nature than the wires, for when the 40 wires are coated with ice and are just breaking, they have a weight of 21,960 lbs., and the weight of wire and crossarms, with the pole hardware, may reach 22,400 lbs.

This indicates that for a pole line, where the poles are vertical and not subject to wind pressure, the strength of the line is more than twice the greatest possible load, for as the wires break the pole will be relieved.

Horizontal Pull a Pole Will Stand

The horizontal pull that an unguyed pole will bear may be found from Table III. In the first column, the diameter of the pole at the ground line is given in inches. In the second column, the factor is the pounds-pressure for breakage at the ground line. This must be divided by the effective length of the pole; that is, from the ground to the point of the resultant horizontal stress. For instance, a pole with a diameter of 12 in. at the ground line, requires a pressure of $\frac{112{,}000}{21}$ lbs., or 5,333 lbs. to break it, if the force is 21 ft. high.

Table III

8 inches	33,600 lbs.
9 inches	50,500 lbs.
10 inches	67,300 lbs.
11 inches	85,100 lbs.
12 inches	112,000 lbs.
13 inches	152,000 lbs.
14 inches	179,000 lbs.
15 inches	217,000 lbs.
16 inches	262,000 lbs.
17 inches	305,000 lbs.
18 inches	347,000 lbs.
19 inches	384,000 lbs.
20 inches	435,000 lbs.

A formula sometimes used also is given as follows:

$$\text{Transverse strength, in lbs.,} = \frac{ASD}{8L}$$

Where A = area at ground line in square in.

S = tensile strength taken at 6,000 lbs. per square in.

D = diameter at ground line in in.

L = effective length, i. e., length from ground to resultant of load.

Taking the same size pole, 30x7, with a diameter at ground line of 12 in., and set 5½ ft. in the ground, the transverse strength at a point 21 ft. from the ground is $\frac{113\times6{,}000\times12}{8\times21\times12} = 4{,}035$ lbs.

This is low compared to the value calculated by the tables, but the tensile strength is taken at its lowest value for soft wood, and may easily be 50 per cent more.

Calculating Ability to Resist Wind

Enquiring next into the magnitude of the transverse stress which the pole will have to resist, it may be pointed out that this value is due only to wind pressure. Various values are given for

the force of the wind, which may be calculated as follows: Let P = the wind pressure in lbs. per square ft. on a flat surface of small area; then $P = AV^2$, where V is the velocity of the wind in miles per hour and A is a constant which will be taken at 0.0042. This is the mean of several values given by several authorities; some values of P are given in Table IV below for different wind velocities:

Table IV

Velocity of Wind, Miles Per Hour	Pressure in Lbs. Per Sq. Ft.
100	42
90	34
80	27
70	21
60	13
50	10
40	7
30	3.8
20	1.7

The effective area of round objects such as wire and poles to wind pressure is 2/3 their diameter × their length. A 30x7 pole, 5 ft. 6 in. in the ground, has a mean diameter of 0.833 ft.; 2/3 of this is 0.55, which multiplied by the length above ground = 24.5 × 0.55 = 14 square ft., nearly. The crossarms, end on, only present 1/3 of 1 sq. ft. and the insulators and braces another 1/3; so, the complete pole has an effective area of 14.66 sq. ft. The area of the wire is 2/3 the diameter, multiplied by length, multiplied by the number of wires.

For 40 No. 12 wires and a 135-ft. span, the area is:

$$\frac{0.66 \times 104 \times 40 \times 135 \times 12}{144} = 31 \text{ square ft.}$$

Add to this the area of the pole and the total exposed area is 45.66 square ft. per pole of 40 wires. The pole will bear 4,035 lbs., so the pressure per square ft. necessary to destroy it is 88 lbs., which is twice the pressure of the wind at 100 miles per hour.

Conditions Which Modify Calculations

If the pole and wires are coated with ice, so that the wires are 1 in. thick, the area for the wires becomes 300 sq. ft. and the pole 15 sq. ft. In this case, the pole will break at a wind of over 60 miles per hour, $\frac{4{,}035}{315} = 13$ lbs. This is not really the case, for when the wires are coated to a thickness of an inch over all, they will sag several feet and as the pressure of the wind decreases very rapidly, the nearer the ground the wires are, it seems quite probable that a wind of 75 miles per hour would be required to break the pole. Figures relative to the variation of wind pressure with height are not available as this is written, but it is evident that the nature of the surface of the ground would largely influence the wind pressure; i. e., trees, hills, etc., would shield the pole line.

Nothing has been allowed above for the shielding effect of the wires on each other. No doubt, a considerable allowance should be made for this, as ice coated wires must form a considerable shield to those on the same crossarm.

Other Factors Which Cause Failure

From the above considerations it appears, that abnormal conditions are required to destroy a pole line in good order, erected according to reliable specifications.

It will, in general, be found that failure of a pole line is due to poor maintenance. What quality of maintenance to sustain can easily be calculated. If the line is twice as strong as required when new, the factor of safety is 2; but, as time goes on, this will be reduced to 1. When such is the case, the danger of failure commences. The amount of rot can be measured and the present state of the line calculated in each case. Rot is not the only danger due to depreciation. When poles are allowed to lean, the vertical load becomes divided into vertical and horizontal components and the horizontal part is proportional to the load, multiplied by the cosine of the angle which the pole makes with the horizontal.

Programme for Indiana Convention, Sept. 19-20

The following is the program for the fourth annual convention of the Indiana Telephone Association, which will be held September 19-20, at Claypool Hotel, Indianapolis:

Wednesday, September 19, 1923

Morning

9:30 A. M.—Registration, 8th floor, Claypool hotel. Visit exhibits and get ready for convention.

10:30 A. M.—Opening convention, Hon. Henry A. Barnhart, president, Indiana Telephone Assn., Rochester.

11:00 A. M.—Reading of minutes of previous meeting. Reports of officers. Appointment of Nominating, Auditing and other committees.

Afternoon

2:00 P. M.—Call to order, Convention hall, 8th floor. Address, F. B. MacKinnon, pres., U. S. Independent Telephone Assn., Chicago.

2:30 P. M.—Report of activities and addresses by district association presidents: Stephen M. Isom pres., Southern Indiana Telephone Assn., Mitchell, Ind.; Wilbur Van Horn, pres., Northern Indiana Telephone Assn., Wabash, Ind.; George W. Watts, pres., East Central Indiana Telephone Assn., Knightstown, Ind.; L. W. Conarroe, pres., Benton Telephone Assn., Brookston, Ind.; P. J. Maloney pres., Northeastern Indiana Telephone Assn., Columbia City, Ind.

Evening

6:30 P. M.—Banquet, Riley room, Claypool hotel, with two of the best after-dinner speakers in the country: Governor Edward Morrow of Kentucky, and Senator Harold F. Van Orman, Evansville, Ind.

Thursday, September 20, 1923

Morning

10:00 A. M.—Call to order Convention hall, 8th floor. Talk on Treatment and Installation of Underground Cables Without the Use of Conduit, by Stephen M. Isom, pres., Mitchell Telephone Co., Mitchell, Ind., followed by discussion.

11:00 A. M.—Address, Dr. Edward C. Elliott, pres., Purdue University, Lafayette, Ind.

Afternoon

2:00 P. M.—Call to order, Convention hall, 8th floor. Election of five directors, terms of following expiring this year: Wm. Bailey, W. W. Harbaugh, S. M. Isom, F. V. Newman and F. O. Cuppy. Reports of committees.

3:00 P. M.—General discussion of any subject pertaining to the telephone industry, led by Frank E. Bohn, vice-president and general manager, Home Telephone and Telegraph Co., Ft. Wayne, Ind.

Interstate Commission Reclassifies Telephone Companies

Washington, D. C.—Two orders affecting the classification of telephone companies have just been issued by the Interstate Commerce Commission. By the new order all companies now classed as C will become D and be required to file with the Interstate Commerce Commission copies of whatever reports they are required to file with their state commission, but will not be required to keep their accounts according to the Interstate system.

By the new order those companies now classified as B, whose gross receipts are between $50,000 and $100,000, will be classified as C companies and will be required to follow the C class accounting system and make C class reports to the Interstate Commerce Commission.

B companies will be those whose gross receipts are between $100,000 and $250,000.

No change is made in the A company classification or requirements.

William F. Qualls, we understand, left the Federal Telephone & Telegraph Co., September 1, but we have not yet learned regarding his future plans.

LINE AND DESK

HINTS ON DROP WIRE INSTALLATION

As practically all drops are No. 17 copper clad twist, care should be used in placing them free of chances to rub limbs of trees, buildings, poles or other wires.

If impossible to get a proper angle of pull where a drop first hits the building, with the standard 2 groove knob, use paragon knob or L bracket.

No drop should be pulled tight. Leave 6 to 12 inches of sag.

All splices in drops, drops to line or drops to inside wire are to be soldered and taped. Tape should not be used unless the wire is soldered or wrapped with foil. Splices should be split and made so that an equal strain is put on both wires when pulled.

Where necessary to strip or cut insulation, always cover with 2 wraps of tape extending about 1 inch each side of the exposed wire.

Not more than two drops should be run with the line wire on 1 two groove knob. These should be dead ended in such a way as will prevent short circuiting by wires cutting through insulation.

No drop is to pull around a pole in such a way as will rub the insulation. Use a knob fastened direct to pole and tie drop to it.

Drops or lines attached to electric light poles should be under the light wires and have a clearance of not less than 3 feet.

Drops or lines crossing trolley should be high enough so that a 12 inch sag will clear the trolley wire at least 6 inches when car passes under the wire.

When necessary to cut aerial corners in drops or lines, these corners should be made so that the wire will not rub over or through a knob. Tie the line to the knob and take a guy wire from center of knob.

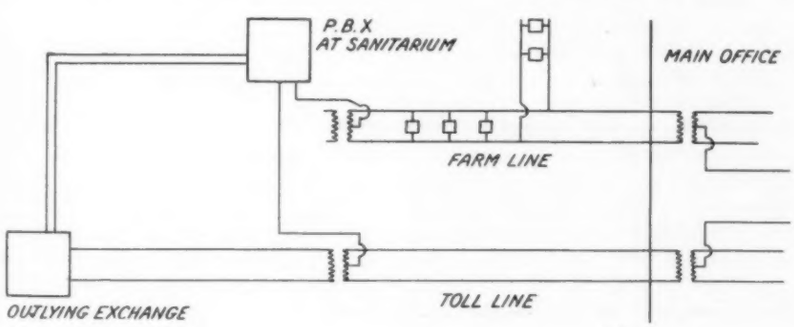
Twist crossing railroads should be tied on each side of track to knob mounted on L bracket or 2 wood brackets and insulators on each side of track.

All ties in twist are to be made so that the tie wire cannot cut into and short circuit the line.

Be sure to note kind and amount of wire used on all orders.—C. W. Kugelman in "Telephone Facts."

A PHANTOM TIP

A sanitarium in the territory of an exchange to which our toll line ran, produced a heavy toll business at certain times. The service through the smaller exchange was not always satisfactory, as the additional switch was a cause of delay. A direct circuit to the p.b.x. at the sanitarium was not justified by the business. At a point near by were the toll line and a metallic farmer line, and as an experiment a phantom was cut in and extended to the p.b.x. board. It proved to be fairly quiet, even before any attempt was made to balance up the circuits. As conditions seemed to be favorable, we cleared up the circuits and put in phantom transpositions and have a very satisfactory circuit at a low cost. We had been told that a phantom could not work on a farm line with bridged stations, but in this case it is working satisfactorily. At any rate, the circuit is good enough to be a marked improvement over the old circuit built up through the other exchange and the local line to the p.b.x. —Contributed by E. W. Swarthout.



RINGING INDUCTION ON REVERTING CALLS

In changing over a number of shorter farm lines from local to common battery operation on an eight-party, divided circuit ringing plan, a scheme was worked out to prevent premature tripping of the automatic ringing cord circuit on reverting calls. The usual practice is followed of asking the calling party to hang up and of ringing back on the line with the calling cord. If the calling party receives no ringing induction, he does not know whether or not the called party has answered. He may take off the receiver too soon and trip the ringing or he may wait too long

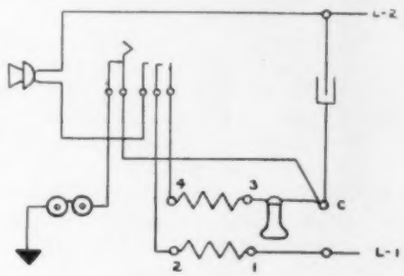


Fig. 1

and the called party may think he has received a false call and leave the line. By a simple change in the substation circuit the calling party can hold down the hook and at the same time hold the receiver to his ear and can tell when the called party has answered.

The type of substation circuit used is the booster circuit shown in the drawing (Fig. 1). This circuit differs from the circuit as ordinarily wired in that the receiver is connected between terminal No. 3 of the induction coil and the condenser terminal. In the ordinary circuit it is between No. 4 and the hook switch contact. There is sufficient capacity between the primary and secondary to give a light ringing induction when the ringing current is on the line and the answer of the called party can be heard as faint cross talk. Some people also use the circuit to determine if the line is busy by holding down the hook, at the same time listening in the receiver, in this way avoiding the click of the hook, if the line is in use.

—Contributed by William R. Brown.

PROTECTION AT UNDERGROUND CABLE DIPS

A telephone manager sends the following query: "We are contemplating putting some overhead railroad crossings underground, using cable. Is it safe to do this without putting protection at each end?"

Our reply would be that the installation of short underground dips of cable in open wire would require protection at both ends. If the lines are open wire and more than one-quarter mile long, there would be present the risk of loss of cable pairs, due to lightning. This trouble occurs most frequently at bends in the cable where the discharge leaves the conductor and goes to the grounded sheath. If there are no power lines present, an open space lightning arrester would be sufficient. There are a number of satisfactory types of arresters designed for use on open wire lines and one of these might be used at each end of the cable. It should, preferably, have a discharge block, other than carbon-to-carbon, to eliminate trouble due to grounds at the arrester.

THE REPAIRMAN AND PUBLIC RELATIONS

We often hear the remark made that the repairman is always "looking for trouble," but if that actually were true he ought to change his occupation. Of course, it is not meant "that way," for the repairman hunts for defects in telephone equipment and the good will of the public towards us depends, quite a bit, upon his ability and his disposition.

As a part of the repairman's work must be done on the subscriber's premises, and often in the presence of ladies, it is highly desirable that he be equipped with a good disposition and a fair amount of diplomacy and patience. And right here should be pointed out the importance of knowing how to locate faults in telephone instruments easily and quickly. If the repairman can find and correct defects in the instrument readily the tendency for irritation of his temper is greatly reduced, and his work will make a good impression upon the subscriber, thereby increasing respect and good will.

The repairman should not say anything to the subscribers about their telephone equipment that tends to make them dissatisfied with it. If he finds, upon inspection, anything in bad condition and likely to cause trouble, he should do whatever is necessary to make it good, instead of telling the subscriber it is bad and then leaving it in that condition.

It is sometimes a good policy to change an instrument for the sake of appearance, if it looks bad and does not match its surroundings, but a new telephone need not be put in for every complaint, of course. Judgment, therefore, is another important part of the repairman's kit of tools.—Ray Rogers in "The Mouthpiece."

"MIT ALL DOSE T'INGS!"

We know a printer who, back in his days of apprenticeship, worked for an old German who owned and operated a very small shop. The equipment of the shop was so limited that often their ingenuity was taxed to the utmost to complete a job to the satisfaction of the customer. This condition brought a great deal of complaint from the few employees. They would often go to the old fellow with the report that certain type or other articles of equipment would have to be purchased before they could go ahead with the job. His reply was always the same: "Mine Gott in Himmel! any fool coodt do it if he hat all dose t'ings."

He would invariably show them a way out. Perhaps it wasn't as easy as it would have been with new equipment, but it served the purpose quite as well. The training our friend got from this old printer has been invaluable. Today he runs his own plant and has often been able to do things without special equipment that other printers said could not be done.

Telephone employees are especially fortunate in having modern equipment with which to do their work. We have no real excuse for not being able to do our job and do it well. Indeed, one may well wonder if too many conveniences don't make a job so easy that it fails to bring out the best there is in us.

A job completed under difficulties affords a great deal more satisfaction than one where every convenience is at hand. If you sometimes feel put out because you haven't some little thing you think you need, why not try the old German's philosophy? It's an opportunity to show what you can do. —"The Transmitter."

National Independent Meeting Chicago, October 23-26

Chicago, Ill.—Plans now being made for the annual convention of the United States Independent Telephone Association promise one of the best attended and most practical meetings of years. Hotel Sherman, Chicago, again has been chosen as the meeting place. The convention is to be held October 23 to 26, inclusive. Manufacturers already are arranging for exhibitions that will be highly interesting features.

Solder Pot with Automatic Heat Control

A new electric solder pot with automatic heat control has been added to the line of J. D. Wallace & Co. It greatly simplifies the problem of heating babbit, white metal, wax and other materials which are slow conductors of heat.

Solder must be kept at a uniform temperature if satisfactory results are to be obtained. When metal is overheated it oxidizes, and this action results in a considerable loss of material and tensile strength, its makers say. The Wallace solder pot is designed to overcome this oxidation. When solder has been heated to 600° F. an automatic control goes into action. This control maintains the temperature of the contents of the pot and prevents overheating and underheating.

This control is an adaptation of the principle used in the steam gauge. A volatile substance, which is very sensitive to heat, actuates a Bourden tube, which makes and breaks the electric current, thus controlling the temperature of the contents of the pot.

The pot will accommodate fifteen pounds of solder and will heat this amount to 600° F. in twenty to twenty-five minutes. This quick action is due to the fact that a 900-watt heating element is built around the entire container. Heat is applied to all parts of the sides and bottom of the container simultaneously, thus coming in contact with the solder at all points and reducing it to a working consistency.

The pot weighs only thirteen pounds, can be easily carried anywhere, and operates on either 110-V. or 200-V. alternating or direct current.

Frank Wampler Named Indiana Public Service Commissioner

Indianapolis, Ind.—Frank Wampler, who resigned as vice-president and general manager of the Indiana Bell Telephone Co., August 23, 1922, has been appointed a Democratic member of the Indiana Public Service Commission by Governor Warren T. McCray. Mr. Wampler succeeds Glenn Van Auken, whose resignation became effective September 1.

Mr. Wampler started in the telephone business when he was 19 and became connected with the old Central Union Co., predecessor of the Indiana Bell. Since his retirement from the Indiana Bell he has been giving a good part of his time to his pure-bred stock farm near his birthplace, Gosport, Ind. He is prominently identified with various civic organizations and is widely known throughout the state.

Reflexed Radio Circuits

Defects in Some of the Existing Apparatus Are Pointed Out for the Benefit of Manufacturers—Remedies Proposed for Correcting Losses in Radio Frequency Stages

By John B. Rathbun

For some months past there has been an increasing tendency toward tube economy, both in regard to the number of tubes employed and also in the filament current consumption resulting from the reduction in the number of tubes. In circuits of this type, commonly known as "reflex circuits," each amplifying tube is made to serve a double purpose, that of amplifying both at radio frequency and audio frequency, while the usual detector tube is generally superseded by a crystal detector. By employing a crystal as a detector, a single amplifying tube can be used which gives one stage of radio frequency amplification, one step of audio amplification, detector and regeneration, a result which could formerly be attained only with three separate tubes. By the use of only two amplifying tubes and a crystal detector, we can get two stages of radio amplification, two steps of audio amplifications, detection and regeneration. The two tubes in this case take place of the five tubes used in the conventional circuits, and while the signal strength is somewhat less than with the five tubes, it is far and away greater than can be obtained by two tubes in the usual type of circuit. Certain losses are inherent with the reflex system, which reduce the actual signal strength and range below the theoretical value.

In the simplest type of reflex circuit employing one amplifying tube and a crystal detector, the charge from the aerial enters the tube directly at the grid, where it receives amplification at radio frequency. The amplified R. F. current from the plate of the tube then enters the primary coil of an air core radio frequency transformer, is transformed at a 1 to 1 ratio, and the induced current is then rectified and reduced to audio frequency by the crystal detector. This detector circuit is in turn coupled back to the grid of the amplifying tube through an iron core audio amplifying transformer, so that the audio current is amplified before passing to the output or phones. The secondary of the audio transformer is connected to the grid return circuit so that the potential impressed on the grid is from five to ten times greater than the potential at the detector.

Such a combination gives perfectly clear and quiet reception, for the crystal detector is an almost perfect rectifier and introduces no hissing or gurgling tube noises, experienced when detector tubes are used, but the signal strength is slightly less than with a detector tube. Regeneration is accomplished in the usual way by a feed back or tickler circuit or by means of a variometer used as a plate or grid tuner. The principal difficulty experienced in the practical construction of these circuits is to keep the tube from oscillating on its own account and thus acting as a detector within itself. When such a condition takes place, the sensitivity is greatly decreased, and the circuit is hardly better than a common regenerative set with one stage of audio amplification.

Free oscillations in the tube circuit can be suppressed in one of two ways or by a combination of both methods: (1) by introducing a high ohmic resistance in the plate circuit which is from five to six times greater than the impedance of the tube, (2) by "neutralizing" the grids of the tubes or offsetting the capacity coupling of the tube elements, or (3) by a combination of plate resistance and neutralization. Owing to the capacity of the tube, there is always a strong tendency toward "coupling back" between stages which must be overcome if amplification is to be at a maximum. Again, the action of the radio frequency transformer must be of a purely inductive nature without capacitance coupling between the primary and secondary windings. As the latter is quite difficult to overcome, much attention has been paid to the "tuned impedance" method of coupling between the tube and crystal detector circuit, and this method has much to commend it.

In tuned impedance coupling, a direct connection is made to the crystal detector from the plate of the amplifying tube, the oscillations being controlled in the plate circuit by means of a variable inductance, such as a variometer or by a tuned inductance coil, controlled by a variable condenser. In this case there can be no coupling back through the capacitance of the transformer and the circuit is much more easily tuned to wave length than with an R. F. transformer.

When the number of tubes are increased, the difficulty of suppressing free oscillations also increases in like ratio. Body capacity effects become very prominent with more than two amplifying tubes and the leakage of radio frequency current reaches a high value. With three tubes, neutralization of the grids is almost a necessity, and the condenser method of neutralization invented by Dr. Hazeltine becomes of increasing importance. In the latter system, the grids of the tubes are connected through special condensers of exceedingly small capacity which are just sufficient to overcome the capacity existing between the grid and plate of the tube.

The common everyday commercial radio frequency transformer is not suitable for reflex circuits. In the first place this transformer is in series with the phones and secondary winding of the audio frequency transformer, and the high resistance of the ordinary R. F. transformer reduces the current in the phones to a very small value. In the second place the distributed capacity of the windings or the inter-turn capacity is so high that most commercial R. F. transformers are capacitance couplings rather than inductive couplings in the true sense. The diameters of the spools are small and the great number of turns of fine wire necessary make it decidedly inefficient as a coupling medium. The transformers introduced by Prof. Hazeltine more nearly fill the requirements, since they are of very large diameter (3.5 in.) and contain relatively few turns of large wire. These condensers are really couplers and are very efficient. It would seem that radio frequency transformer design should receive more consideration than it has in the past in view of the increasing interest in reflex circuits and radio frequency amplification in general.

The fact that the highly inductive secondary winding of the iron core audio frequency transformer is in series with the radio frequency circuits seems to make very little difference in the performance of the circuit, since the distributed capacity of these windings is so great that the R. F. current passes through the coils with little resistance. The use of bypass condensers across

such inductances is seldom necessary, and very frequently is undesirable, as the added capacitance also tends to short circuit the audio frequency waves. Almost any commercial audio transformer acts very well in reflex circuits.

As a hint to those of the telephone companies who are making radio frequency transformers, it would be interesting and perhaps profitable to experiment with transformers constructed along spiderweb lines. That is, the primary and secondary should be parallel spiderweb coils separated by a small air gap. It has been repeatedly proven, when spiderweb coils are used as tuning inductances, that losses are reduced to a minimum and that a greater percentage of the flux is utilized in linking the two halves of the circuit together. The distributed capacity is reduced to a minimum and the distance between parallel primary and secondary turns is practically constant at all points in the field.

When an outdoor aerial is used with these receivers, it is generally best to avoid the use of a variocoupler as a tuning inductance. This is another tip for those companies who may be engaged in the manufacture of radio parts. A "split variometer" with the rotor circuit detached from the stator circuit is much better, as it avoids losses due to the taps and tap switches. The stator winding, or half the stator winding, (depending on wave length), is connected to the aerial at one end and to the ground at the other. The two ends of the rotor are connected to the secondary circuit. Still simpler, and just as effective is the use of a special coupling transformer. This consists of a secondary winding placed on a tube, with the secondary wound over it and well separated from it by about 1/16 in. of cardboard or other sheet insulation. Such tuning units are also superior for circuits other than the reflex. Two honeycomb coils, the smaller inside the larger, form an excellent tuning unit of the stationary coil type and are very compact.

Biasing the tubes by placing a small "C" battery in the grid return leads is very often of advantage, particularly when the dry battery tubes are used. These cells, which range from three to ten volts, maintain a negative potential on the grid which develops the maximum amplifying capacity of the tube.

From now on, manufacturers of radio apparatus will be compelled to make concessions for the new circuits along the lines suggested. While primarily intended for the reflex circuit, they can applied to other circuits with profit.

EDITOR'S NOTE—Mr. Rathbun will be glad to answer questions on radio from our subscribers. Address him, care of TELEPHONE ENGINEER, 28 E. Jackson, Chicago.

Northern Indiana Meeting at Rochester

The Northern Indiana Telephone Association met at Lake Manitou, Rochester, Ind., Sept. 3-4. It was attended by about sixty owners, managers and linemen, while as many more local and long distance operators attended the school conducted by Miss Shea of the Indiana Bell. A large number of Rochester folks also turned out to hear the tribute paid their fellow townsman, "Uncle Dan" Agnew, who was among Indiana's pioneer telephone men. Wilbur Van Horn, of Wabash, president of the district, gave the opening address, followed by Henry A. Barnhart, who gave the address of welcome and ended with a tribute to Mr. Agnew, former general manager of the local plant. Judge Hunter, of Wabash, gave the response and Mr. Agnew expressed his appreciation of the honor paid him. President MacKinnon of the United States Telephone Association, spoke on the "Future of the Telephone Industry as a Business," and Frank E. Bohn, of Fort Wayne, led the discussion. Mr. McKinnon's speech was a most encouraging prospect for those seeking modest but sure, interest earning securities for investors. He also gave assurances that the wireless telephone can never take the place of the commercial lines, which must be used in order to carry prompt and satisfactory communications. Charles S. Norton's address on "Better Long Distance Equipment and Service," forcefully reflected the growing conviction of both telephone men and the public that there must be closer and more perfect relations among owners of toll lines in order to give good service and that there must be fewer and more expeditious switching centers in order to give speedier service. The giving of wire chiefs and chief operators more authority in furnishing help and equipment was pointed out as a good way to improve both long distance and local service. F. O. Cuppy, of Lafayette, led a free-for-all consideration of telephone problems common to all exchanges. Max Hosea, of Noblesville, secretary of the Indiana Telephone Assn., talked on general subjects pertaining to the business.

The next meeting is to be held at Knox in three months.

Brorein's Company Gets St. Petersburg Plant

The St. Petersburg, Fla., telephone system has passed into control of W. G. Brorein's Peninsular Telephone Co. of Tampa, giving the latter control of the systems in four counties and placing it among the leading Independents of the country.

Independents and Bell Divide Pennsylvania Territory

A division of territory has been effected between the Consolidated Telephone Co. and the Bell Telephone Co. of Pennsylvania, whereby the Consolidated company shall operate the combined exchanges in the following towns: Hazleton, Freland, White Haven, McAdoo, Weatherly, Mauch Chunk, Leighton, Slatington, Catasauqua, Allentown, Coopersburg, Bethlehem, Hellertown, Easton.

The Bell company, according to the agreement, will operate the combined exchanges in the following towns: Honesdale, Hawley, Waymart, Carbondale, Jermyn, Peckville, Olyphant, Scranton, Taylor, Moosic, Pittston, Wyoming, Kingston, Miners Mills, Wilkes-Barre, Plymouth, Nanticoke, Glen Summit, Kutztown, Fleetwood, Hamburg, Reading, Boyertown.

Bell Gets Raise in 12 Indiana Cities

Judge George T. Page of the federal court recently granted the Indiana Bell Telephone Co.'s prayer for a temporary order to establish new rates that will give the company revenue totaling about $50,000 a month more than would have been obtained under the Indiana commission's order, or an increase over the present rates of about $1,600,000 a year. This $50,000 a month increase will be paid by twelve Indiana cities, including Indianapolis, Anderson, Shelbyville, South Bend-Mishawaka, Jeffersonville, Newcastle, Bluffton, Vincennes, Peru, Kokomo, Hartford City and Muncie. The company originally asked permission to put in effect schedules that would have raised its revenues about $1,900,000.00 a year.

Number of A. T. & T. Stockholders Grows Fast

The number of American Telephone and Telegraph stockholders continues to increase at the rate of from 2,500 to 5,000 a month. Today there are 270,000 registered shareholders.

Illinois Bell Spends $15,000,000 This Year

The Illinois Bell Telephone Co. has approved an expenditure of $4,260,043 for a new plant in the city of Chicago and $1,054,501 for Illinois outside of Chicago, making a total of $5,314,544. The total approved this year is $14,534,845.

Ben C. Schweitzer, for the past four years with the J. G. Wray Co., Chicago, has been appointed commercial manager of the Home T. & T. Co., Fort Wayne, Ind.

New Pole Raising Derrick

Description of a New Device that Has Been Developed Recently and that Has Marked Advantages in Handling Poles Economically—From an Article on Labor Saving Machinery in "Electrical Communication"

BY J. N. KIRK

Outside Plant Engineer, Department of Operations and Engineering, American Telephone & Telegraph Co.

An active period of development and experimental field work has resulted in making available a light type of high grade steel tube derrick for pole raising.

Figures 1 and 2 show a pole derrick of the latest type mounted on a 2½ ton truck. Figure 1 illustrates the method of erecting a pole where the truck can be maneuvered into a position in close proximity to the proposed location of the pole. Figure 2, on the other hand, shows the possibility of handling a pole at a considerable distance from the location of the truck, which for any reason may be more practicable or desirable.

These illustrations show the derrick in each of the two possible operating positions; in the first instance supported entirely upon the truck, and in the second, supported from the ground by one of the three pipe members. The derricks of this type are constructed of high grade steel tubing having a strength at the yield point of approximately 70,000 pounds per square inch.

In order that country-wide conditions may be satisfactorily met, the present type of derrick has been made available in two general types which are known as the "middle" and "corner" types for use, as the names imply, from the rear middle or the corner of the truck. Each of these types are further available in light and heavy weights, depending upon the lengths and the kinds of poles, cedar or chestnut or other kinds of similar weights, that are generally used in any particular part of the country.

As contrasted with the early type of derrick, the present light middle type weighs from 370 to 520 pounds, depending upon the size used, and is capable of readily and safely handling any load within the limits of the winch rope capacity which leaves a satisfactory margin when doing practically any work for which the derrick has a place in telephone construction.

Fig. 1—Erecting pole, all derrick members mounted on truck

Each of the four classes of derricks above mentioned is designed with a view to making its operation as rapid as is consistent with safety. The chauffeurs and one man can remove the derrick members from the carrying racks provided on the truck, assemble them and erect the derrick ready for work in from three to four minutes. The disassembling of the derrick requires about the same length of time.

Naturally, the greatest economies may be made in the application of this apparatus where the poles to be handled constitute a consecutive line, the holes for which have been dug in advance. However, because of the short time required for assembling and taking down the derrick, it is generally economical to use it for placing only one or two poles at a location. As indicative of the possibilities with regard to rapidity of operation, it may be of interest to note that in erecting a number of 30 to 35 foot poles under average conditions in a line for which the holes had previously been prepared, a gang of three men have averaged approximately two minutes per pole erected but not tamped.

The use of the derrick has thus far been described as applied to the economical erection of poles. There are, as a matter of fact, many other important uses for which the winch-operated truck is well adapted, a few of which are enumerated below.

Road and highway changes and improvements throughout the country make it necessary for the telephone companies to annually move thousands of poles to the new highway limits or curb lines. In many instances these pole lines carry heavy loads of wire or cable or both. With the pole derrick many of these moves can readily be accomplished without in any way disturbing the wire or cable loads. The derrick pulls the pole out of the ground and with the aid of the truck the pole with its load intact is moved to the new location where it is lowered into

(Continued on Page 26)

Fig. 2—Erecting pole at distance from truck, one derrick member on ground

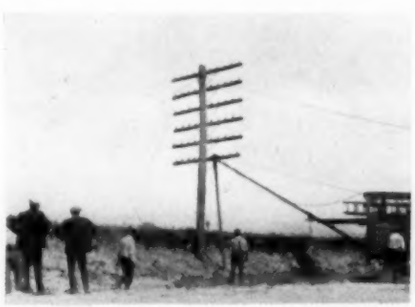


Fig. 3—Derrick in position to pull pole out of ground

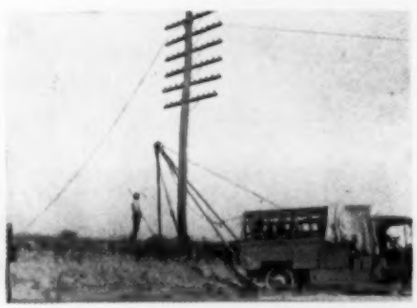


Fig. 4—In position to shift pole to new location. Pole has been moved over bank with wires intact

The Telephone Company Wants Dividends Well as the Subscribers Want Efficient Servi

Every telephone manager who is in the market for a new switchboard wants primarily switching apparatus that will pay the company to operate, namely, one that will pay dividends. A fair profit is what we're all in business for and nobody, least of all the subscriber, cares about the type of apparatus employed to produce these results except to minimize their effort, chances of error or delay and cost of service to them.

Of course, the service must be efficient, and that word, efficient, to the subscriber means getting his parties on the phone quickly, his ability to hear them; to the manager it means reliable, economical operation, and to the owners of the company it means all of these things, and a reasonable first cost—as low a first cost as possible. And it must pay a profit.

To the manufacturer, "efficient" is his ideal too, and to him it means equipment that is practical, reliable, long-wearing and salable at a fair profit.

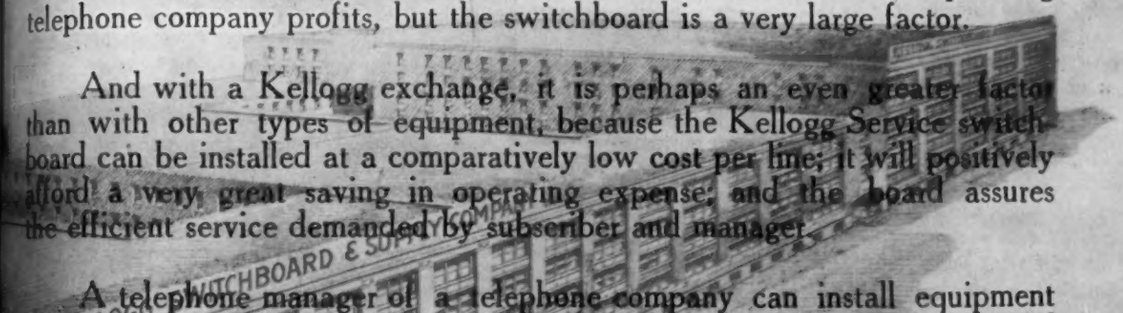
In "Telephone Facts," we are publishing from time to time illustrated articles showing the great number of prosperous Independent telephone companies today. Of course, those that we show are practically all Kellogg and they are a very high percentage of the total number operating "efficiently," meaning efficient as described above.

We have today nearly three hundred Kellogg Service switchboards in exchanges that are, every one of them, "paying dividends" in the sense of operating at a good profit. This is true of our other types of switchboards, but being smaller exchanges, and in many cases more limited in growth or financing, it is not true to the extent that it is in exchanges operating our Service Feature switchboards.

We want every prospective buyer of telephone switchboards to investigate this matter of all around efficiency, that is, the paying of "dividends." We don't want you to just visit a few Kellogg exchanges. We want you to find out, not necessarily from enthusiastic managers, but from reliable, unbiased sources, not only what our exchanges are accomplishing, but what operating companies using boards and switching equipment of other manufacturers are doing.

It takes time to do this and it costs money, but it pays. Every prospective buyer of a switchboard should do it. Directors and owners, as well as managers, should understand the importance of it. A fund should be set aside for that purpose, and it is money well spent. Don't just go to Kellogg exchanges—go to exchanges operating other types of switching equipment. Find out from disinterested towns people just what they are doing, whether it be very well, only fair, or very poor.

To be sure, it is not always the switchboard which makes operating telephone company profits, but the switchboard is a very large factor.



And with a Kellogg exchange, it is perhaps an even greater factor than with other types of equipment, because the Kellogg Service switchboard can be installed at a comparatively low cost per line; it will positively afford a very great saving in operating expense, and the board assures the efficient service demanded by subscriber and manager.

A telephone manager of a telephone company can install equipment costing much more than Kellogg; there are several types of machine switched and semi-automatic equipment available, but if his interest is in the profit which the switching will give, we suggest that he assure himself as to just what dividends the various equipments are paying in actual service.

As stated before, the Kellogg Company manufactures that type of equipment demanded by the public, but the public, while they won't always admit it, want a telephone company in their town that is successful, that is making a profit, because without this profit, no company can, in the long run, either satisfy its patrons or give service.

The real, the necessary demand of every organization, or director, or manager, is to operate at a good profit—be assured of a dividend producing plant.

With Kellogg, Use Is The Test.

Kellogg Switchboard & Supply Company

Main Office and Factory: CHICAGO, ILLINOIS

Branch Offices and Warehouses:

COLUMBUS, OHIO 211 N. Front Street

KANSAS CITY, MISSOURI 407 Broadway

PORTLAND, OREGON 357 E. Burnside St.

SAN FRANCISCO, CAL. 1054 Mission Street

the hole prepared without even untying a wire or loosening a cable clamp. It will also be readily appreciated that the rehandling of cable and particularly the untying of open wires is not only an expensive operation in point of first cost, but that each such operation is distinctly detrimental to the plant, shortening its life and greatly increasing maintenance expenses. It will be seen, therefore, that the use of the derrick where practicable in connection with the moving of existing lines will largely eliminate the undesirable and costly procedure which is involved in the manual handling of the poles.

As an example of one of the many uses to which the pole derrick can very satisfactorily be put, Figures 3 and 4 illustrate the initial and final steps in moving back a pole in a 6-arm lead of wires and lifting it up an embankment to its new location in connection with highway widening. This particular line is about 60 miles long and the distance the poles were moved varied between 6 and 125 feet. It is reported that the move of this entire lead which averaged about 4 arms was completed without untying a single wire, without cutting any slack and with practically no trouble on the circuits. It is needless to say that the saving involved by being able to move this line rather than rebuild at the new location was an item of considerable importance.

In Figure 4 the pole is shown after having been pulled out of the ground and placed on top of the embankment. The derrick is ready to shift and slide the pole back to the new hole. Two men and the chauffeur pulled and completed the moving of this pole with its load of six arms of wires in twenty-five minutes.

Another important function of the derrick is that in connection with the resetting of poles or the removal of abandoned poles when it is necessary to remove the butts. The slow and laborious process of pulling the pole out of the ground with a jack or other equipment is practically eliminated as the derrick, properly handled, is capable of doing the greater part of this work in much less time, more economically and with greater safety to the men.

In addition, it might be pointed out that the derrick equipped truck is also becoming more and more indispensable in connection with the handling or moving of any heavy loads in the storage yards, in unloading or in moving stock supplies of poles under adverse conditions and many other uses.

Telephone Income Increases 15%

Operating income of the seventy-two telephone companies reporting to the interstate commerce commission aggregated $71,518,000 for the six months ending June 30, 1923. The figures represent an increase of 15 per cent over the corresponding period for 1922. The operating revenues for the seventy-two companies for the six months totaled $319,283,080, 11 per cent greater than for the first six months of 1922. The companies expended $220,787,650 in cost of operation, while for the same period last year operating expenses amounted to $202,375,478.

SYMPATHY for JAPAN

The sympathy of the telephone fraternity, everywhere, goes out to stricken Japan. While details are still lacking, it is known that the empire's public utilities have suffered heavily and that the telephone industry sustained its full share of the loss in lives and property. The task of rebuilding will be gigantic.

Rural Phone Switching Rates Are Investigated

Oklahoma City.—A thorough investigation into the cost of conducting the rural telephone business of the state is being conducted by the Corporation Commission in connection with a hearing begun August 31 at the instances of John Simpson, president of the Oklahoma Farmers Union. In April, 1922, the Commission made a 33⅓ per cent blanket reduction in the charge for switching rural telephone lines. Seventy-seven telephone companies in the state failed to make the reduction, believing that the order was not applicable to their particular situation. About one-third of these had applied for exemption from the rule but had had no action taken on their applications. The attention of the Commission being directed to the situation by the Farmers Union's president, a notice to all such companies was given to appear August 31 and show cause why the rule should not be enforced. The hearing was resolved into a conference at which it was decided that an examination of each company should be made by mail as a result of which the Commission would fix a rate. A questionnaire is being sent to all companies concerned this week. The results will be tabulated and analyzed and the matter given further hearing on October 1st.

A. H. Skinner Buys Two Ohio Exchanges

A. H. Skinner has bought of H. E. Marlatt the Mowrystown and Buford (Ohio) telephone exchanges. Mr. Skinner took charge September 1, makhis headquarters at Mowrystown.

Lawyer Loses His Case

Verdict Is Set Aside in Case of Grimes vs. Northwestern Bell

At Minneapolis, not long ago, a jury voted George S. Grimes, a lawyer of that city, $1,000 damages against the Northwestern Bell Telephone Co., alleging that Grimes had lost that much of his valuable time because of faulty and inadequate telephone service.

This verdict now has been set aside by a higher court which holds that "Grimes, as a professional man, rated his services at $6.00 an hour, so that if, in the course of a week, he lost an aggregate of ten minutes each day at the phone, that would represent $6.00 in damages." . . . In other words, the plaintiff would charge the defendant company for professional time at the professional rate whenever he saw fit to use the telephone, no matter how trivial the message and regardless of whether any financial loss were involved.

"But this theory of plaintiff's," the court says, "is not the rule and cannot be the law. . . . Mere loss of time may result in no damage at all. . . . No rule on any theory will justify a compensation to plaintiff upon values in money or property which he has not actually lost.

"Another rule of law fatal to the verdict in this case, as demonstrating its excessiveness, is that plaintiff was under an obligation to minimize and not enhance his own damages. Plaintiff offers no satisfactory reason why the lady clerk in his office, employed at $3.00 a day instead of $50, should not have answered this 'phone which he says was persistently causing him so much damage. This item alone would reduce a $1,000 damage to approximately $60."

L. E. Morier Added to Page and Hill Staff

Dayton, Ohio.—Laurence E. Morier has become eastern sales manager for Page and Hill Co. and will make his headquarters at 855 Reibold Bldg., Dayton. Mr. Morier is well known to telephone men and is fully qualified by previous experience in the industry to carry forth the Page and Hill platform of capable personal service to its trade.

More McKay Material Next Issue

The customary contributions of Chas. W. McKay arrived too late for insertion in this issue of TELEPHONE ENGINEER. Our readers may look forward to their appearance in the next number.

Hooks, Ringers, Magnetism

Fifth Instalment of Higgins' "Everyday Telephone Helps" Deals With Certain Fundamental Parts and Principles of the Telephone That Every One Engaged in This Industry Should Understand

By P. Kerr Higgins

Pertaining to the Switch Hook

The switch hook, sometimes known as the hook switch or gravity switch, is that part of the telephone instrument on which the receiver is hung when not in use. The weight of the receiver pulls it down and in this position the connections are such that a signal can be received on the ringer or sent out on the line by the hand

Fig. 1—Typical switch hook

generator while the battery contacts are open to prevent waste of current. When the receiver is lifted, the hook moves upward and makes the connections suitable for receiving and talking. The types of switch hooks are legion, but they are practically the same in principle. For many years the long style of hook switch was very much preferred, but lately the short type is more popular. Figs. 1 and 2 illustrate two modern types.

By the introduction of a "hold" or "battery saver," the hook switch can be held in an intermediate position, so that on local battery type telephones one can hear without being heard. This apparatus is used on rural lines and results in a great saving of battery expense. The same result can be obtained by cutting a stop in the metal shield of the hook switch and pulling the hook lever forward by a spring. The hook switch on being released goes into the listening position and one has only to push it back in order to talk. Hanging up the receiver or pulling down the hook restores the switch to its normal position. When the battery saver is used, it is found best to use the two top springs for the battery circuit. Be sure the batteries of the instrument are always connected so that the switch hook will open the battery circuit when the receiver is hung up.

In view of the fact that many cases of instrument trouble develop in the hook switch, great care should be taken to see that it works freely. If the hook does not come clear down, the trouble is usually found in the pivot or in the spring controlling the hook or the hook itself being bent

In some types the contacts are made of cheap German silver or brass. In these types blackening or corroding of the contacts is very common, introducing resistance into the circuit and decreasing the efficiency. When this trouble is suspected it may be remedied by using a piece of tough manilla or linen paper between the contact points and pressing the points together, drawing the paper through them several times. Even in the best constructed types of switches dust will accumulate and can be removed in the same manner. Many of the more modern types of switches are provided with rubbing or scraping contacts, equipped with platinum or tungsten points and this has greatly reduced switch hook troubles. Poorly soldered connections at the switch hook including "resin joints"

Fig. 2—Short lever switch with removable hook

should and can be avoided by the use of a hot well tinned soldering iron. These connections should be carefully examined.

When a switch hook is suspected of not operating properly as shown by an abnormal waste of battery, the primary circuit should be tested while the receiver is on the hook by placing a good receiver in series with the battery. No click should be heard in the receiver. Examine switch hook contacts to be sure that the adjustment is good and all contacts solid. Weak springs, another source of trouble, may be remedied by heating the spring to a red heat and then dipping into water, or if too hard by using oil instead of water.

Regarding the Ringer

The ringer is a device placed in the telephone instrument to receive audible signals. In magneto systems, it is operated by current similar in characteristics to that given out by a hand generator, which of course is an alternating current, making about 16 complete reversals per second. The ringer usually consists of a permanent magnet, a soft iron armature, to which is attached the clapper that strikes the gongs. This armature is operated by a U shaped electro magnet, Fig. 3, wound with a large number of turns of very fine wire. A permanent magnet is used in conjunction with the electro magnet to polarize the armature.

The calling alternating current causes

the iron armature to strike first one gong, then the other, this movement being in step with the ringing current. The gongs are so arranged that for each movement a gong is sounded, and this action is kept up as long as the current passes through the ringer.

When sent out from the factory, ringers are usually properly adjusted and will continue to work for a very long period under ordinary conditions without any re-adjustment. Notwithstanding this fact, many linemen and others proceed to make adjustments without first trying to determine what the trouble is and failure is the inevitable result. Very often the trouble is not in the adjustment, but in a partial short or a partial open ringer winding, in which case the trouble may be located by placing a receiver in series with one of the wires leading to the coils and then having some one at the distant station ring. Even when the ringer is open some sound will be heard and with a little practice the difference between the good and the bad ringer can be easily determined. It is very seldom that the windings become short circuited, but when this does happen it is due either to damage by lightning or injury due to being struck by a hard instrument. The strap between the two coils forming the ringer is usually placed back of the magnet yoke and sometimes accidentally gets in contact with the magnet of the metal frame, in which case one of the coils might be short circuited.

In making adjustments of ringers, the following instructions have been issued by a well known manufacturer: When the armature is adjusted to be nearer or further away from the core, the throw of the clapper is altered and the positions of the gongs in relation thereto must be altered.

1. The armature should be so adjusted that it vibrates freely under regular line conditions when the distant station is ringing.

2. The gongs should then be set so that when the armature is pressed against first one core and then the other, the clapper almost, but not quite touches each gong. The distance between the clapper and gong may be about one thirty-second of an inch.

3. Under all circumstances avoid bending the clapper rod sometimes known as the hammer. This should be centrally located in reference to the gongs so that each gong is struck with equal force.

4. If the gongs are not being struck equally, the gong that is struck the heavier should be moved away from the clapper. This procedure gives better results than moving the lighter struck gong toward the clapper or hammer.

For the sake of uniformity, it is found advisable that all of the ringers on the same line be of the same resistance. It is recommended that all magneto type instruments used for city work be of one thousand ohms resistance and that those used on rural lines should be of sixteen hundred ohms, the only exception to this being on very heavy rural lines where many engineers recommend twenty-five hundred ohms. So far as transmission efficiency is concerned, it is immaterial whether the line is equipped with one thousand ohm ringers or twenty-five hundred ohm ringers, as the impedance of either to the high frequency voice currents is enormous. A sixteen hundred ohm ringer has a little over ten thousand turns per spool, while a twenty-five hundred ohm ringer has thirteen thousand turns.

Troubles Found in Ringers

The cores of ringer spools are usually made from Norway or Swedish iron, which is a special grade of iron that does not readily become permanently magnetized. This iron reaches the manufacturer in rods which are worked

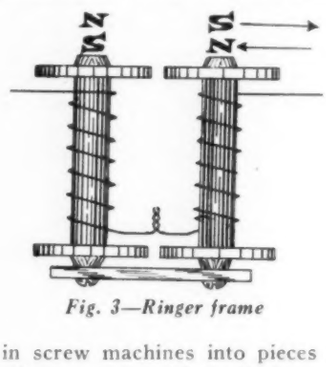


Fig. 3—Ringer frame

up in screw machines into pieces for the ringer cores. After all the work on the iron has been completed it is necessary thoroughly to anneal the cores, as the process hardens the material so that it will tend to remain magnetized, which is fatal to the successful operation of the ringer. This annealing of the cores is done by packing them in charcoal or some other suitable material in cast iron boxes and subjecting them to uniform heat for a period of time, after which they are allowed to cool very slowly. If this work is not done carefully the cores will not be thoroughly non-magnetic, that is, they will not be in condition rapidly to reverse the direction of magnetism, which is one of the most important requirements. It is very difficult definitely to ascertain that the cores are in proper condition and in spite of all efforts to eliminate defects, many cores get out into the operating field in such a hard condition as to cause sticking. When these ringers are found the ringer spool should as a rule be returned to the manufacturer for replacement.

Armature sticking or freezing, as it is sometimes called, is one of the most annoying troubles in connection with ringers. The indications of freezing are that the clapper (or hammer) will lie against one gong and if a party calls there will be a faint buzz or rattle of the armature, but not a good ring. If the clapper is moved with the finger it will start ringing and will operate satisfactorily for perhaps a day or more, when the sticking will commence again. Sometimes the telephone will ring its own bell all right, but cannot be called by others, and this trouble is more noticeable on long or heavily loaded lines than on short ones.

In diagnosing this trouble great care should be had to discriminate between freezing caused by residual magnetism in the cores and practically the same effect produced by the flow of some foreign electric current through the instrument. If this is the cause the clapper will tend to stick positively to one side and if moved to the other side with the finger will immediately return to its original position. Reversing the line wires on the top of the telephone will cause the clapper to move over to the opposite side and if the wires be reversed rapidly will cause the bell to ring. In this case, the cross or leakage will have to be removed.

Efforts on the part of local trouble men to remedy residual magnetism in the cores will make it necessary to take the wire off the core and carefully drive the spool heads off the iron cores. The cores should then be thoroughly annealed by heating them to a cherry red color in a closed iron vessel which may be filled with finely divided charcoal or ordinary coal ashes. Then let the fire die out and do not remove the vessel from the fire. Cover it with ashes and let it cool very slowly. After the annealing process has been completed, be very careful not to file or otherwise work on the cores as this will harden them again. The fiber heads may then be pushed back on the cores and the coils may be rewound and placed back in service. This work if done properly will eliminate sticking. When freezing is suspected and before the work of dismantling the ringer is begun, the armature should be examined to see that it is not bound in the pivots on which it rocks, which would have a tendency to make the ringer sluggish. In this case a little adjustment of the movable pivot or occasionally a drop of oil would eliminate the trouble.

The following quick method of testing ringers in the exchange has been

suggested: A shunt coil is prepared having a resistance of forty ohms and is placed across the terminals of the telephone as shown in Fig. 4. If the ringer under test is a thousand ohm ringer, it will operate well with its own generator with the shunt across the telephone. ' Turning the generator at the usual speed should cause the bell to ring. This would mean that the ringer is operating under the same conditions as if it were on a line with about twenty-five others of the same resistance. This method not only offers a quick way of testing and adjusting ringers, but also enables us to compare the efficiency of different types of makes of ringers. By making the shunt a variable one, which can

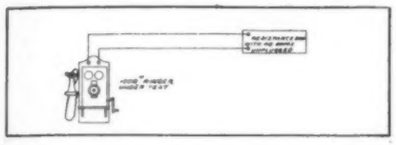


Fig. 4—Arrangement for testing ringers

be done by using an ordinary resistance box or Wheatstone bridge the ringers may be compared in terms of percentage.

In the matter of coils it has been found that much money is wasted not only in first cost but in the up-keep by having windings of greater resistance and hence with wire of greater fineness than is absolutely necessary. This matter should receive the careful consideration of those using telephone equipment. Some ringers are so designed that in order to adjust the gongs, the gong itself must be taken from its post, which makes it difficult to make suitable adjustments because gong adjustments should be made while the striker is being vibrated by current over the line in order to get the best results. In modern practice the gongs are mounted on the same metal frame that supports the magnets and other working parts; hence the whole ringer becomes a solid unit which may be put into or taken out of the telephone as a whole without in any way changing its adjustment.

Magnetism—Its Three Divisions

It is not the intention in these articles to discuss theory any more than is absolutely necessary. However, the importance of understanding the fundamental principles of magnetism is such that it is of advantage in discussing the substation to cover a few of the essential features pertaining to this subject.

Magnetism may be considered in three divisions. (1) Permanent magnetism as exemplified in the permanent magnets of the receiver, generator and ringer. (2) Electro magnetism or that produced by the action of an electric current on soft iron and seen in the induction coil, the electro magnets of the ringer, the armature of a motor, etc. (3) Electro magnetic induction, wherein current is produced through magnetic action as in the magneto generator. Permanent magnetism was first discovered in what is known as the lodestone, an iron ore possessing the peculiar properties of attracting iron and other magnetic bodies.

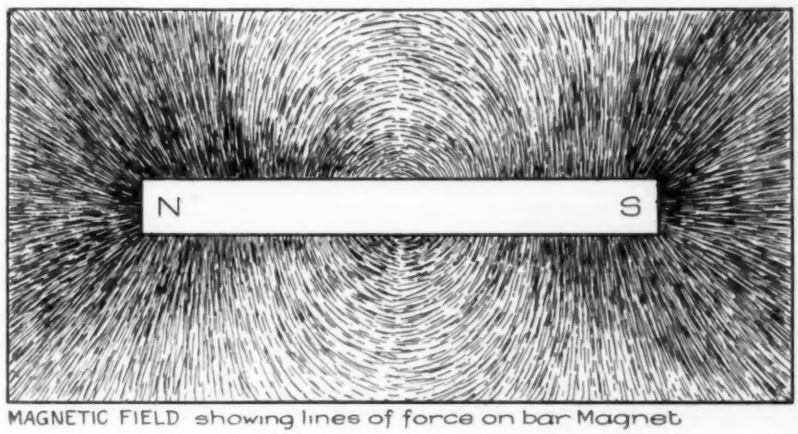
As in electricity, there is always a negative and a positive charge, so also in magnetism there are two polarities. These are called the north pole and the south pole. These terms are derived from the fact that if a magnet is suspended so that it will swing freely, the opposite poles will tend to point to the magnetic north and south poles of the earth. A fundamental polarity law in electricity as in magnetism is like poles repel each other and unlike poles attract each other. While iron or steel magnets may be considered as a unit, theoretically they are made up of many magnets for each and every molecule forming the magnet is an individual magnet in itself. The proof of this is that by breaking a magnet into several pieces, each piece is a magnet of itself having its own north and south pole. The retention of magnetism in iron depends upon the hardness of the iron. Soft iron can be magnetized much easier than steel but does not retain the magnetism as well as steel.

The space surrounding a magnet is known as the field of force, which is shown schematically in Fig. 5. This field of force consists of lines of force which pass through the air in curved lines from the north to the south poles, thus closing the magnetic circuit. Electro magnetism is produced when a current of electricty flows through the conductor and a portion of its energy is converted into other forms of energy. For example, the resistance of the circuit produces heat and the inductance of the circuit develops magnetism. It may be noted here that the magnetic field is always at right angles to the conductor, and hence to the direction of the current producing it. If the current flows through a straight wire the magnetic field will be weak. If however, the wire is wound in a coil or solenoid, the magnetic field will be greatly intensified due to the concentration of the lines of force. The strength of a magnetic field therefore depends upon the number of turns of wire forming the coil as well as on the strength of the current flowing through it. The product of the current and the number of turns which is called ampere-turns.

Elements of Electromagnetism

Two basic facts of electromagnetism are known to all telephone men. The first is that when a current is flowing in a conductor, a magnetic field surrounds it. The second is that if the magnetic field around a conductor is changed, a current will flow in the conductor if its circuit is closed. This current exists only when a current is made or broken in a primary circuit, or where there is a change in the magnetic intensity of the field, and the action is known as electro magnetic induction. The originating circuit is known as the primary and the other as the secondary as in the induction coil. It is also well to remember that the currents set up in the secondary coil move in opposite directions to the primary. The inductive effects in the secondary will be found to decrease the farther it is removed from the primary and increase as the two coils are brought close together.

The inside of a coil or solenoid is called the core and may be composed of air or iron and since iron is a better conductor of magnetism than is air, naturally a core formed of iron will have more lines of force concentrated therein and the inductive effect in the secondary will be greater. Hence if the primary and secondary are wound on a core of iron the magnetizing force of the current in the secondary



MAGNETIC FIELD showing lines of force on bar Magnet

will be considerably greater than if the core was formed of air. The voltage in a secondary coil is governed by the relative number of turns in the primary and secondary coils. It is directly proportioned to the rates of secondary turns to primary turns. This method of changing electric energy into magnetic energy and the magnetic energy again into electric energy is termed transforming the current. The device for making the transformation is known as a transformer. Transformers are of two kinds, first, open core transformers and, second, closed core transformers. When the voltage in the secondary of a transformer is higher than that of the primary, it is known as a step up transformer and when lower, it is termed a step down transformer.

The strength of a magnetic field depends upon the number of lines of force per unit area of cross section and according to Coulombs law the attraction and repulsion of the oppositely disposed poles is inversely proportionate to the square of the distance between them. Various substances differ greatly in the degree in which they can be magnetized and for this reason, air has been taken as unity. The conductivity of a substance to the magnetic lines of force is known as its permeability, while the resistance offered to the passage of magnetic lines of force is called reluctance. The magnetic lines of force set up by a current passing through a turn of wire of a coil cut the turns next to it and induce in them other currents opposite in direction to that of the initial current just as if they were turns of a secondary coil. This produces a reactive effect which resists to some extent the initial current. This opposition to the energizing current is called the reactance and is not the true or ohmic resistance of the wire. The sum of the effects of the true resistance and the reactance is called impedance. Reactance does not depend on the size or material of the wire, but solely upon the change in the magnetizing lines of force.

Study of the Magneto Generator

Having discussed briefly the theory of magnetism as it applies to telephone practice, we are now prepared to consider the magneto generator. In reality this is a revolving-armature alternating-current generator. As in all generators, the magneto is composed of two essential elements. First is the field structure, in this case the permanent magnets whereby the magnetic flux is produced. Second is the armature which revolves between the ends of the horseshoe magnets and carries the inductors which cut the flux. The voltage at the generator terminals is determined by the size of the generator, the speed at which it is turned, and by the resistance of the external circuit through which current is forced. In other words the voltage is affected by the number of stations connected to the line and by the resistance of the line wire. The greater the current which the generator sends to the external circuit, the lower will be the voltage delivered by the generator. The reason for this is that as the current increases, the internal drop due to armature reactance of the magneto also increases, which decreases the effective pressure at the terminals of the generator. This is the reason for the three classes of generators in common use, namely, three bar, four bar and five bar, which represents the number of permanent magnets in the magneto. On an external circuit of seven thousand ohms resistance a five bar magneto operated at one thousand revolutions per minute would deliver to the line about one hundred and five volts, a four bar about ninety volts and a three bar about eighty volts.

A magneto generator driven by hand has an average speed of sixteen revolutions per second or approximately one thousand revolutions per minute. It must be remembered, however, that it is only the armature that turns at this speed, the pinion on the armature being driven by a gear which turns at the same speed as that of the hand of the operator. The total flux developed in the air gap by the permanent magnets depends on the following factors: First, the number of magnets used; second, the size of the magnets; third, the quality of the steel and, fourth, the heat treatment accorded the steel. Armature windings on magnetos vary with the size of the magneto. The five bar No. 48A Western Electric Generator has an armature winding of twenty-one hundred turns of No. 29 black enameled insulated copper wire with a resistance of about 108 ohms, while the three bar No. 50A generator has twenty-seven hundred turns of No. 35 single cotton covered insulated copper wire, with a resistance of about three hundred and seventy-five ohms.

The ordinary magneto generator produces a current which is called alternating because part of the time it flows out to the line in one direction and the balance of the time it flows in the other direction. This current is never constant, but varies continuously in value owing to the fact that the wires forming the conductors on the armature cut the lines of force at various rates of speed. In a complete revolution of the armature a current is sent out on the line, the value of which increases from zero to a maximum, then decreases back to zero again. Its direction is then reversed and a similar fluctuation in its value takes place. Each reversal is called an alternation and there are therefore two alternations per revolution or per cycle. If one of the directions in which the current flows be called positive then the other is taken as negative. Hence currents flowing are known as positive and negative currents. The shape of the wave length has a good deal to do with the ringing ability of the magneto generator. It is well known that the simple sine wave is the best for transmission purposes because it possesses no higher frequencies to cause undue loss in passing over lines or through equipment. However, a slightly peaked wave is considered by some to be better than the sine wave because it exerts a strong pull in the ringer armature and clapper, thereby giving a stronger hammer blow on the gong.

In many classes of telephone work it is desirable to have the current rectified or changed so that it flows in one direction only. For this purpose a device commonly known as a commutator is used and consists of a slip ring placed on the armature shaft which rectifies the current so that it will pass out continuously in one direction. The connection of this commutator may be so arranged that the current will always be positive or negative as desired.

Two methods of testing the generator are used: The first is made by placing the fingers across the terminals. If the generator is O. K. a shock will be felt. The second is by ringing a bell. If the bell is of the same instrument, a piece of metal is placed across the terminals of the instrument if it is series or the terminals are left open if it is bridging. The first method of testing is preferred as it will serve with either type of instrument.

Magneto troubles usually consist of open armature, demagnetized magnets, magnets poled wrong, defective bushings, or springs not making proper contact. The defective bushings may be either in the armature itself or in the springs at the end of the armature. A sluggish or noisy armature movement can usually be remedied by a little oil being placed at the point causing friction. All contacts in magnetos should be made and kept tight and the springs should be frequently examined as holes sometimes are worn in them and cause trouble. Oil should only be used in connection with magnetos sparingly.

Employees Share Earnings

Entire Organization of an Illinois Telephone Company Shares in the Earnings After a Certain Return on the Investment Has Been Earned—Staff Correspondent Tells How it Works

By a STAFF WRITER

This is the story of a telephone company in a somewhat out-of-the-way corner of a great middle-western state, and of its men and women who serve the various communities in which it operates at a cost that these communities can afford to pay.

Perhaps your geographical knowledge does not enable you to locate Pike County, Ill., readily on the map. In this case, you may call Mark Twain to your assistance. If you can locate the Illinois side of the Mississippi River as Tom Sawyer and Huck Finn did, you are close enough for practical purposes. It is a different Illinois side now, however, for the swamps have been drained and the lowlands protected by levees from floods. Where rushes and swamp grass grew, now grow corn and wheat, second not even to that which grows on the uplands of the great central prairie. Pike County is not all bottom land, however. Lying between two great rivers, the Mississippi and the Illinois, much of it is rough and hilly. The productivity of the soil in the hill country cannot be compared to prairie soil to the east of the Illinois. There is lacking that general air of prosperity that is so much in evidence in the central Illinois farming districts. Since the ability of the farmer to pay for telephone service is proportional to his general prosperity, it is evident that the Pike County farmer as a class is not able to pay the rates of the average farmer of the state. And this is reflected in the rates of the telephone company, so that only through efficient management can quality service be furnished at a profit to the stockholders.

The Pike County Telephone Co.

The Pike County Telephone Co. operates over the greater part of the county. It has 12 exchanges, the largest of which switches 542 stations and the smallest 98. The total number of stations is 3,033, of which 2,343 are company owned and 693 are stations of mutual lines, switched at the exchanges of the company. The exchange at Pittsfield, the largest town of the county, is not owned by the company although it is under the same management.

The books of the company show the present value of the plant to be over $170,000 and it has outstanding $80,000 in common stock. It has no bonds or long term obligations. The maximum rate is $24 and the rural rate is $16, net. It has paid dividends over all of its 26 years of existence except for a period of two and one-half years just prior to 1920. This brief picture of the financial standing of the company is of interest in connection with the arrangements that it has made for sharing profits with its employees.

Most telephone men of Illinois and many throughout the entire country know Ed. D. Glandon, general manager of the company. Mr. Glandon has been active in association affairs for many years. He was four times president of the Illinois State Telephone Association, is now president of the Toll Clearing Co. as well as one of the directors of the United States Independent Telephone Association. He organized and incorporated the Pike County Telephone Co. and the property has grown to its present state under his management. His activities have not been limited to the telephone field but have extended into church and civic activities. He is president of the Commercial Club which is fathering many improvements that are rapidly changing Pittsfield from an out-of-the-way country town to a progressive small city. As a hobby Mr. Glandon has a farm of several hundred acres in the southern part of the county where he has installed a modern hog-feeding plant and is experimenting on the building up of low grade soil into productive farm land.

The Profit Sharing Plan

When the TELEPHONE ENGINEER correspondent arrived at Pittsfield and explained his mission, Mr. Glandon very courteously supplied the details of his company's profit-sharing plan but declined to comment on its working. "You can get that better by talking with the people who work for the company and who profit by it," was his suggestion.

After the company secured an adjustment of rates in 1920, the plan was put into effect and is now in the fourth year of its working. In July, 1920, the following letter was sent to each employee, giving details:

TO THE EMPLOYEES OF THE PIKE COUNTY TELEPHONE CO.:

You and the stockholders of the Pike County Telephone Co. have been partners for a good many years in providing telephone service to the people of Pike County and up to this year the company has assumed the responsibility of earnings and taken what was left after paying salaries and other expenses. Some years there has been nothing left and for more than probably 15 years there has been no dividend paid in excess of 6 percent.

During the past year something had to be done to protect both the stockholders and employees. The earnings for 1919, after all expenses were paid, were only about $5,000.00, or about 3 percent on the present value. Upon a showing to the commission we secured an increase in rates and the earnings should be better this year.

Since the stockholders and the employees are so largely dependent upon each other, this company has decided to change its policy somewhat in order to permit the employees to share in the earnings, above a very ordinary rate to the investors.

The plan is as follows: That out of earnings of the company for 1920 there shall first be set aside for the stockholders 4 percent on what is known as the present value of the property, or about $6,500.00. The earnings in excess of this 4 percent shall be divided 50-50 between the stockholders and the employees on the following conditions: No employee shall participate until after he or she has been with the company one year and each employee must remain in the employ of the company during the year to December 1st, except for cause over which he or she has no control. The money so paid shall be divided pro-rata among those entitled to receive it in the same proportion that the total wages of each bear to the total amount to be distributed.

Under this arrangement the company also extends to its male employees who work full time, July 4, Thanksgiving and Christmas as holidays with pay.

To the woman employees who have been with the company one year or more, the company extends a vacation of one week on pay on the condition that said vacation is taken between June 1st and August 31st, and that said person shall provide a satisfactory substitute while away, at wages not to exceed that paid the one taking the vacation. Vacation periods shall be arranged so as not to conflict and so that the service will not be interrupted.

The above plan is more in the nature of a reward for loyalty than an effort to secure it. We feel that you are loyal and we hope that its working out may justify its continuance.

You now become financially interested in what is going on about you, and we solicit your suggestions.

In response to a question about wages and working conditions, Mr. Glandon said: "Compared to other telephone companies, we do not pay a high scale of wages. Until the last two or three years, we have had no industries and there has been a surplus of labor here. We are paying liberal wages when compared to current wages in the community, but they are not as high as telephone companies have to pay in industrial communities where living costs are higher. Our men work 9½ hours in summer and 9 hours in winter and our women work 8½ or 9 hours, depending on sched-

ules. Many of our people have been with the company for a long time. Our wire chief has been here 26 years and our construction foreman 20 years. Some of our agents in the smaller exchanges also have been with the company many years.

"Last year we were able to pay $2,700 to our people under the profit sharing plan. This amounted to about 10 percent of the annual wages of those entitled to participate. About Dec. 15th, when we are able to estimate the approximate amount, we pay each employe one-half of his share of the estimated amount. In January, after the books are closed for the year, the balance is paid. In this way a portion of the payment comes before Christmas when it is much appreciated."

What the Employee Has to Say

Following Mr. Glandon's suggestion, the correspondent next went to the terminal room where he met Mr. Floyd Rader, assistant wire chief. He did not meet Mr. Linville, the wire chief, as the latter just then was confined to his home by illness. Later Messrs. Thomas and Glenn Linville, repairmen, came in at the close of the day's work and the usual fanning bee commenced. The talk drifted around to the profit sharing plan and the interest of the employee was evident. It is not possible to quote all of their comments but the reply of Mr. Rader to a suggestion of the correspondent is typical. "I suppose you think twice before you throw an insulator at a dog that runs out to bark at the truck. Not only that," said Mr. Rader, "but the boys check up on each other. If one of them wastes a piece of material, somebody else is sure to say, 'there goes part of your bonus.'"

Out With the Line Gang

That night the correspondent abandoned the late-to-bed, late-to-rise habits of the city and at 7 a. m. was at the warehouse ready to go out with the line gang. As guest of honor, he was given a seat with the driver of the truck which went spinning away over several miles of the concrete highway that will be Pike County's link in the Ocean-to-Ocean road. At the village of Detroit, the truck turned off from the main road onto a road of hills and valleys that gave a real test of the skill of the pilot and of the ability of the correspondent to hang on. Finally, the gang arrived at a place where it was engaged in overhauling the farm lines of the Milton exchange.

The foreman went ahead to look over the work, the driver took the truck to town for a load of poles and the gang fell to work on the line. Every pole was tested. If it was weak, it was set down if clearance permitted, or was replaced. Trees were trimmed, slack was pulled and the line left in shipshape. The correspondent engineered himself into a spot of cool shade for a mid-morning smoke and, when the gang came up, interfered with the efficiency of production for a while by getting the men into conversation. A lineman called "Coon," whose night and Sunday name was not learned, was the principal spokesman. "You bet, I am looking forward to cutting in on it this year. I wasn't here long enough to get anything last year. At that, I can't complain. The company sent over a big turkey at Christmas because I did not get a share."

"Last year was the first time I got anything," said one of the others. "It was over $80, and I'll tell you it came in handy."

"Of course," said Coon again, "some fellows say that they would rather have that much added to their regular wages instead of getting it as a bonus, but I don't know, the plan looks all right to me."

By this time Foreman Little had come up and was listening. "That kind of talk is all bunk. When you get it this way, it is just like finding it. You get along all right on your regular pay, and if you got more wages right along, you'd spend them as you went. Besides, how can the company tell how much it could give if wages were raised. The way it works now is the best way."

Over the Hills in a Ford

Mr. Glandon came along in a Ford roadster a little later and the correspondent departed for a tour of the southern exchanges of the county. After a short stop at Milton, the next exchange visited was Pearl, the smallest of the company. Here, for several years, the operating and collecting has been cared for by Mrs. Lacy with the assistance of her daughters. This lady was an enthusiastic booster for the plan. "The extra money comes in just right at Christmas, especially where there are many stockings to be filled. The week's vacation in the summer is fine."

After leaving Pearl, the road climbs the hills and finds its way toward Nebo. Mr. Glandon's farm is located between the two towns and the correspondent was taken past the fields where sweet clover, soy beans and alfalfa are converting erstwhile bare clay knobs into productive farm land.

At Nebo is the residence of Cleve Franklin, who cares for three exchanges of the company in the southern part of the county. Mr. Franklin is, apparently, a man of superior ability who has served as county supervisor and in other responsible ways, outside of his work with the telephone company. "You may think that I am over enthusiastic," he said, "but we are all for the plan, heart and soul. It works out for the interest of the employees and they have confidence in Mr. Glandon and know that they are getting a square deal. I might be doing other things, but I have been with the company for 14 years and I am going to stay as long as they want me. I only hope that some day they will be able to arrange to sell some of the stock to the employees."

As time was short and the distance to be covered was great, only short stops could be made at Pleasant Hill, Rockport and New Canton, but wherever the operation of the profit sharing plan was discussed, opinion was unanimous in favor of it. As all of the discussions were out of the hearing of Mr. Glandon, they could not be ascribed to his presence and the sincerity of the employees was apparent.

Barry a Model Exchange

At Barry, a town of 1,500, on the Kansas City line of the Wabash Railroad, was found what might almost be called a model exchange. This property was acquired by the Pike County company about 4 years ago and has been completely rebuilt. Most of the cable plant is underground and the open wire lines are in excellent condition. The central office is housed in a building owned by the company which provides plenty of space for the terminal room and for supplies. A well furnished business office and cheerfully and comfortably furnished operating room and operators' quarters occupy the front of the building.

The traffic and commercial work is in charge of Mrs. Dolly E. Bridge, and Max Wike with an assistant takes care of the plant of this and three other smaller exchanges. "We are proud of our office and of the people we have, and of the company we work for," said Mrs. Bridge. "We think the telephone office is the best place in town to work and we were flattered the other day when the minister's daughter came in to apply for a position. We are just like a big family and when we have our little parties, Max brings Mrs. Wike and their two lively boys and we have a great time."

When the correspondent was discussing plant matters with Mr. Wike, he found that the latter had only one complaint. He felt that he was not getting the plant up to the standard he had set, as rapidly as he had hoped. The correspondent had observed the plant and from what he had seen did not think there was much else to be done. A look into the terminal room and store room gave some insight into

Max's ideals of plant maintenance. There every class of material had its own place on shelves and in bins. Every piece of material was in its right place and everything was in perfect order. There is no doubt that a man with such a fine instinct for orderliness will suffer sharp discomfort when he sees a pole out of line or a crooked cross arm. It is certain that the time will come when every part of the plant for which Mr. Wike is responsible will be in the same condition as the material in his store room.

Time was not available for visits to the exchanges at Hull, Bayliss, Griggsville and Perry, so the journey turned back toward Pittsfield. On the way back, Mr. Glandon spoke of some things that he had not mentioned before. "By this time you know what our people think of the company and its work for their benefit. Probably you know more about their opinions than we do. They have talked more freely to you than they would to us. From our own observations, we think that the company has a group of loyal and interested employees who understand its ideals of service and who give their best efforts to give that service. What has been done for their benefit is a start. We hope to do other things. Many of the things that larger companies do, we can not do alone. We hope that they may be done through association. We would like to provide sickness and old age benefits. We would like to have connections so that an employee who advances to a point where we can no longer provide a large enough opportunity for him, may be transferred to another company that can offer more, and at the same time he may retain the benefits to which he is entitled through years of service with us. The National Association is working on this and we hope that it soon will have a workable plan that all Independent companies may take part in."

We Come to Au Revoir

When Pittsfield was reached, there was just time for the TELEPHONE ENGINEER representative to gather together his belongings and climb aboard the two-car train that hauls passengers to the main line, several miles away. He left with regret that he had not been able to get better acquainted with all of the splendid group of people who are giving their best efforts for the telephone service of Pike County. But—he also left with a feeling of satisfaction that the Golden Rule is not yet entirely obsolete in the business world and knowing that here, at least, is one company applying it daily in its relations with its employees and with the public. May their tribe increase!

Independent Service

Opinions of Independent telephone men generally agree with the suggestion advanced by TELEPHONE ENGINEER editorially in the August issue, for an "Independent four and one-half per cent" sum to be used for services similar to those obtained by Bell companies in return for the license contract charge.

Comment of men well known to the industry, who are in a position to judge the logic of the proposal, is aptly summarized by the statement of Ed. D. Glandon, secretary and manager of the Pike County Telephone Co., Pittsfield, Ill., and President of the Illinois Independent Telephone Association.

Mr. Glandon expresses his ideas as follows:

Ed. D. Glandon's Opinion

"The writer, as president of the Illinois Independent Telephone Association, felt and still feels that a great service could be rendered to the small operator by visits from one who is capable of advising along all of the lines of activity with which the small-company manager has to deal. On account of the small resources at his command, it is not possible for the small-company manager to get out and become familiar with all the short cuts and up-to-date methods employed by others. Not only is there a large field for service by such a man, but there is much to be learned and re-contributed to the business from smaller operators who have devised their own plans, which often are more economical and efficient than the methods in general use. If the results of such initiative on the part of those untutored who have been forced to assume control of properties simply because there was no one else to handle them, all could be assembled, it certainly would prove no inconsiderable addition to the business.

"As to the establishment of a department, akin to the supervisory department of the A. T. and T., but adapted to the needs of the smaller companies, I am of the opinion that, if a suitable personnel can be found to man the State Association, it would be a good thing both for the carrying out of the thought expressed above and the supplying of additional service in financing, as well as in legal matters, and in engineering and in standardizing Independent service. Demand for these services has created a supply of lawyers, engineers and specialists who have rendered a great service to Independent properties, but there are many companies which are drifting along in need of service, even thought they may not know it, and which never get in touch with our attorneys and engineers. To my knowledge, however, these specialists have helped many without a penny for their service.

"The rendering of this service probably would have to be financed largely by those who have less need for it than those who need it most. I see no great reason why Illinois could not carry out such a program without any great difficulty, in view of the men and the money at the command of the Association."—Ed. D. Blandon.

Service Is Needed—Mitchell

Jay G. Mitchell, telephone engineer, writes:

"The editorial is a most timely one, and calls attention to a condition which has been obvious to disinterested observers in the telephone industry for some time. There is no question that telephone companies other than those owned by the Bell must provide, either individually or through state and national associations, for service very closely akin to the service rendered to Bell companies by the American Telephone and Telegraph Company, for which a charge is made of 4½% of the gross revenues ordinarily.

"While this is a fact that cannot be controverted, there is considerable confusion in the minds of Independent operating telephone executives as to the extent to which such services may be referred to their state and national associations. It is probable that this is due to the fact that the time has come when telephone associations find that the field in which their activities may be carried on is a different field from the one in which the activities of telephone associations were formerly carried on. For this reason the field of telephone association activities must be expanded gradually and in accordance with demonstrated abilities to produce results. When results are produced there will be no difficulty whatever in securing and retaining adequate financial support. The Illinois Telephone Association has already embarked on a program of this kind, and will announce within thirty days the creation of an entirely new department which will function along constructive lines and which will supplement the other activities of the association in every way.

"It is necessary to proceed, however, with the utmost caution in order to disarm rather than arouse prejudice."

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"The tip of the bolt makes clean contact even on a rusty rod"

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STANDARD SCREWS (BB-10-36)

Tapping and Thread Cutting Data

TAP DRILLS FOR "V" THREADS. The following table gives the sizes of the tap drills used when approximately 0.75 percent of the full standard thread is used.

TAP DRILLS FOR 60° VEE THREADS

Thread diameter inches	No. threads	Drill diameter inches	Thread diameter inches	No. threads	Drill diameter inches	Thread diameter inches	No. threads	Drill diameter inches
¼	20	7	1	10	21	1⅜	6	1⅜
⅜	18	11	1⅛	9	23	1½	6	1½
⅜	16	11	1¼	9	25	1⅝	5	1⅝
7/16	14	11	1⅜	8	27	1¾	5	1¾
7/16	12	11	1½	7	29	1⅞	4½	1⅞
½	12	11	1⅝	7	31	2	4½	2
9/16	11	7	1¾	7	1	2¼	4½	2⅛
⅝	11	1	1⅞	7	1⅛	2½	4	2¼
¾	10	11	1⅞	7	1⅛	2¾	4	2½

TAP DRILLS FOR SMALL "V" TAPS. These values are for the small taps running from ⅞ inch to ¼ inch. Here "numbered" drills are used as tap drills.

TAP DRILLS FOR SMALL "V" THREAD TAPS

Tap diameter inches	No. Threads	Drill number	Tap diameter inches	No. Threads	Drill number	Tap diameter inches	No. Threads	Drill number
7/64	60	55	5/32	32	32	11/64	28	20
7/64	60	52	5/32	36	35	11/64	32	20
1/8	48	47	5/32	40	33	3/16	22	19
1/8	56	46	5/32	30	31	3/16	24	19
1/8	60	46	5/32	32	30	3/16	28	18
9/64	32	45	5/32	36	29	3/16	30	17
9/64	36	44	5/32	40	29	3/16	32	15
9/64	40	43	11/64	32	30	13/64	22	13
9/64	44	43	11/64	36	29	13/64	24	10
5/32	48	42	11/64	40	28	13/64	28	10
5/32	32	40	3/16	24	27	13/64	32	9
5/32	36	38	3/16	28	26	7/32	20	9
5/32	40	37	3/16	30	23	7/32	22	7
5/32	44	36	3/16	32	23	7/32	24	5
5/32	30	35	11/64	24	21	7/32	32	2

TAP DRILLS FOR S. A. E. THREADS. In this thread, the thread profile is the same as the U. S. Standard thread but the number of threads per inch for a given tap diameter is greater.

TAP DRILLS FOR S. A. E. THREAD TAPS

Tap diameter inches	No. threads	Drill diameter inches	Tap diameter inches	No. threads	Drill diameter inches	Tap diameter inches	No. threads	Drill diameter inches
¼	28	0.213	⅜	18	0.500	1	14	0.921
5/16	24	0.272	⅜	18	0.562	1⅛	12	1.031
5/16	24	0.332	7/16	16	0.625	1¼	12	1.156
7/16	20	0.386	½	16	0.687	1⅜	12	1.281
½	20	0.437	⅞	14	0.796	1½	12	1.406

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Planning Ahead for Thrift

The Telephone Industry Shows Other Fields How Its Command of Significant Data Enables It To Forecast Development Twenty Years in the Future.

By Harry B. Thayer*

President American Telephone and Telegraph Company

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"It is conceivable that cables of telephone wires could be laid underground, or suspended overhead, communicating by branch wires with private dwellings, country houses, shops, manufactories, . . . uniting them through the main cable with a central office where the wire could be connected as desired, establishing direct communication between any two places in the city. Such a plan as this, though impracticable at the present moment, will, I firmly believe, be the outcome of the introduction of the telephone to the public. Not only so, but I believe in the future wires will unite the head offices in different cities, and a man in one part of the country may communicate by word of mouth with another in a distant part.

"I am aware that such ideas may appear to you Utopian and out of place, for we are met together for the purpose of discussing, not the future of the telephone, but its present.

"Believing, however, as I do, that such a scheme will be the ultimate result of the telephone to the public, I will impress upon you all the advisability of keeping this end in view, that all present arrangements of the telephone may be eventually realized in this grand system."

* * *

That quotation is from a statement made to intending investors 45 years ago by Bell. Beginning in 1878, and even before there was a telephone exchange in existence, Professor Bell's vision of the future appears, and from the very beginning a general plan has governed the policies of our organization and appears in its records and publications.

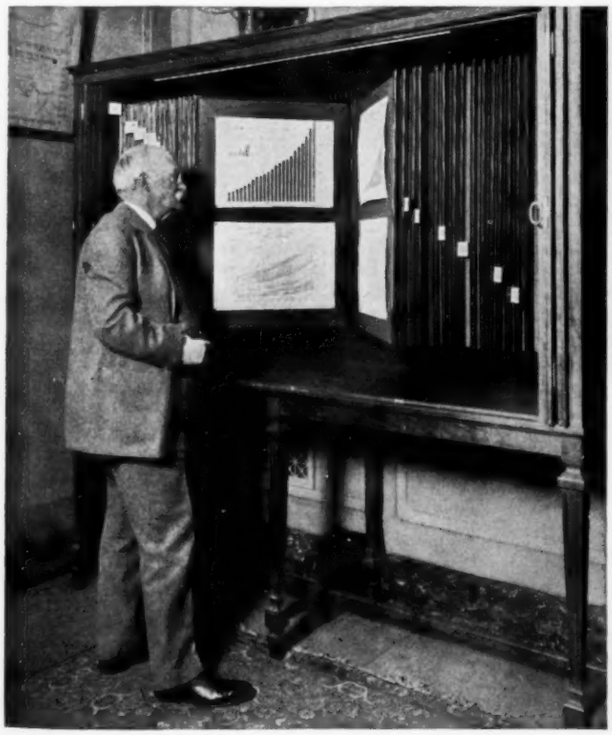
For instance, the pioneers in our activities saw that it would be necessary to provide instruments, so they make a long-term contract with the then largest manufacturer of electrical apparatus for delivery at uniform, reasonable prices.

This has saved the Bell companies millions of dollars.

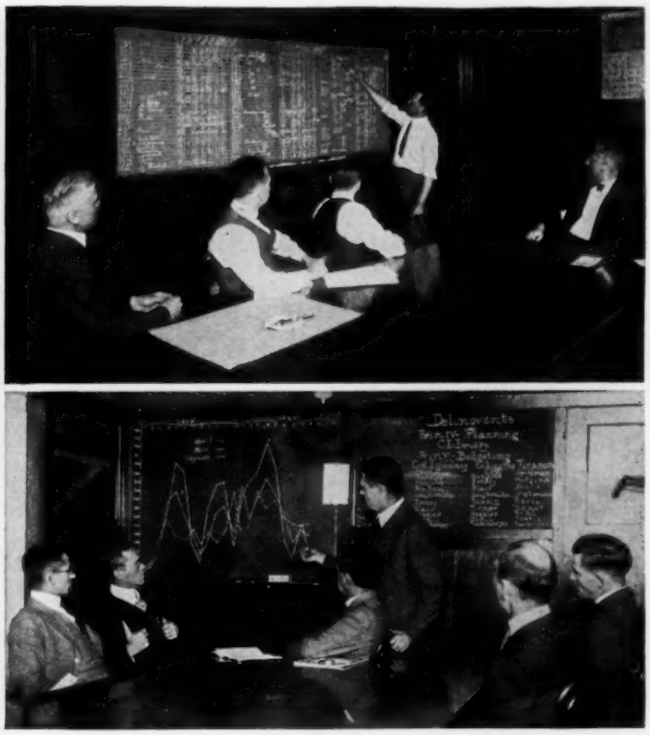
They saw it would be necessary to have an engineering organization of experts and inventors to develop new apparatus and advise operating companies on methods. Near the beginning of the first ten years the parent company established a central headquarters staff for technical and commercial studies of better methods. It is no exaggeration to say that the services of this staff now make it possible for the operating companies to furnish service to the public at rates at least 25% less than would otherwise be possible. These services were responsible in one typical year, in which costs were analyzed, for $39,000,000 savings.

Vision is as necessary in business as intelligence or judgment.

In trying to define vision I find my-



Mr. Thayer's "Chart-Room"—"Whenever a colleague from our own or associated companies is visiting me, very likely we go into this chart-room—it is adjacent to my office—and study the major facts and figures of our business"



"Chart-Rooms" in some other businesses—Here are the rooms in which two businesses—not public utilities and not so very different from almost any business—chart out their progress. "Dream rooms" are practicable in practically every line

self distinguishing between eyesight and foresight, between the look ahead at things that, thought distant, are yet visible to the executive's eye, and the longer look ahead that goes over the horizon and beyond it.

Good management calls for a business course charted in advance. Against this the daily position may be checked. It is hardly enough for an executive to know where he is. He must know where he is going, else he may be steering blindly.

Like the captain of a ship, a business executive needs a chart-room, where he can calculate the currents of business, take cognizance of the prevailing winds, make sure of the capacity of his machinery and crew, figure out his speed, and compare his known direction with the course plotted on his chart far ahead and over the horizon.

Many executives have such a mental chart-room and make constant use of it. Many have physical chart-rooms, and this practice is growing more extensive as the possibilities and benefits of charting statistics relating to production, sales, markets, supplies, the business cycle, and so on, are more appreciated.

Throughout the Bell System we need physical chart-rooms, where work done, work to be done, statistics and data of many kinds may be pictured in chart form for our information, study and guidance.

Our business continually astonishes us with the number and extent of the factors to be known and studied. A mental chart-room would not serve any of our responsible executives. There is too much to know and watch and prepare for.

I have a chart-room, a good deal like that of a ship. It is adjacent to my office, a few steps from my desk.

The office windows, on an upper floor of our building on Broadway, overlook a multitude of buildings served by telephones, but we get a much clearer, farther view from the interior of the chart-room. It is an inside room with no windows, but it is lined with charts which enable us to look beyond the horizon and into future years.

Charting the Growth of a Business Twenty Years Ahead

Whenever a colleague from our own or associated companies is visiting me, very likely we go into this chart-room and study the major facts and figures of our business.

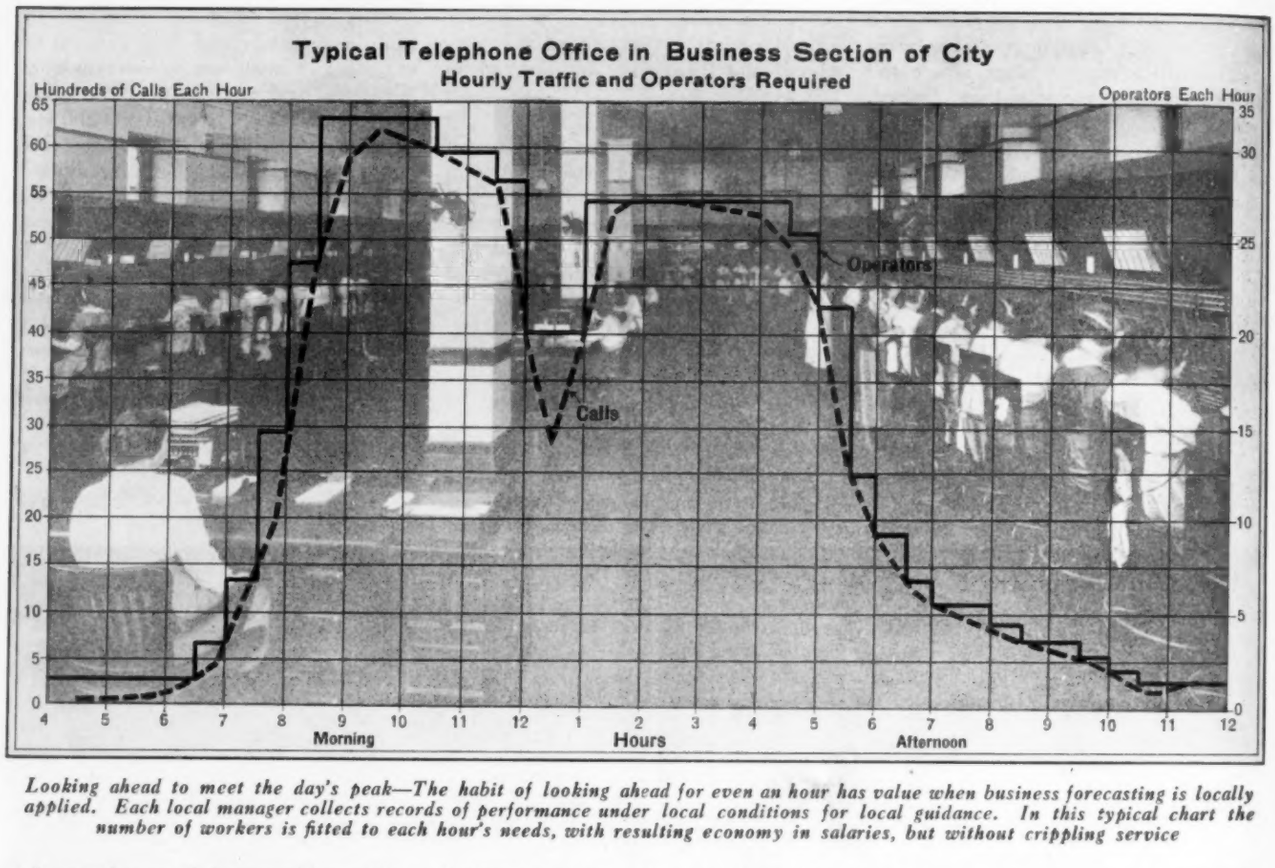
On the charts we study the figures of ten years ago and the past year and the current year, and observe the trend.

What is the rate of growth? What will be the probable demands in this or that locality one year from now? Two years? Five years? Then we use the charts to prepare to meet future demands.

We often look into the future as far as twenty years, and by doing so we are able to make quantitative plans of the greatest value. Actual budgets are made up from one to five years ahead for expenditures needed in the more immediate future. And our various engineering problems require forecasts for different periods.

Cities grow both intensively and extensively. In the business districts large buildings replace small ones. Certain areas change from residence to business in character. People move further and further from where they work. Our survey experts must carefully study the rate and direction of past growth, and investigate the trends of movements in business and residence sections, so that a forecast may be obtained covering both the extent and the direction of the future growth.

In short, we seek to know where, years ahead, the people of the coming community will work and live. Homes, shops, banks, theaters, factories, office buildings, transportation systems yet to be built, are in this forecast. The community as it will exist a decade or more in the future is thus imagined, and upon this picture is imposed the most economical and efficient telephone sys-



Looking ahead to meet the day's peak—The habit of looking ahead for even an hour has value when business forecasting is locally applied. Each local manager collects records of performance under local conditions for local guidance. In this typical chart the number of workers is fitted to each hour's needs, with resulting economy in salaries, but without crippling service

tem possible, that shall continue equal to ever-growing needs.

Let us suppose that our future business in a large city is to be studied. The organization is always ready—the local and district workers, thoroughly familiar with the conditions they are in daily contact with; the survey specialists from the general office of the operating company; and also, at the headquarters of the parent company, a department that conducts general studies of national conditions, and assists the associated companies in the development and standardization of survey methods.

A complete survey of a large city begins with the division of the city into districts—that is, sections in which the buildings are of the same character, and where the rents for houses, apartments or business places are approximately uniform.

The tenants (families or firms) in each district are then analyzed, to discover the relations that exist between the proportion already receiving service, the classes of service subscribed for, whether direct or party line, the approximate rentals that are being paid, and so on. This rental index, of course, is not an arbitrary yardstick, but merely a temporary classifier to help us in our forecasts.

Usually the districts can be grouped into larger areas having a particular character, such as those devoted to manufacturing or retailing, to offices, to tenements, to foreign nationalities. The character of a neighborhood constitutes an important index of the kind of demand that will come from that neighborhood, and we try to analyze it thoroughly.

Such investigations result in a mass of significant data that bear importantly on the further study undertaken to foresee the probable changes in the distribution of the population.

Such surveys are extremely complicated matters, but the cost is negligible compared with the results. They tell us how large to build our central offices and where to build them. They enable us to estimate closely our requirements for apparatus and supplies. They tell us when and where we must enlarge the organization. They afford data for the economical purchase of materials by our manufacturing department. They give us a manufacturing program and a financial program. They result in economical construction, economical operation and economical maintenance.

An economy is needed, for if the function of our institution is to give service, a secondary purpose is to keep down costs and rates, which is another way of giving service. The percentage of profit has remained within a small margin, the company has grown in size and in the total volume of net profits, and has an unbroken dividend record, at sufficient rates which secure the enlistment of new capital for further development.

Perhaps the greatest single economy within the control of an executive in any line of business is the economy of looking ahead.

Giving the best possible service at the lowest possible cost involves more than a responsibility to the telephone users of today. We must be ready to give service to all who apply and when they apply. We are ready today because of the foresight of yesterday, for new service demands in all but a few localities, where post-war conditions have been especially difficult to combat.

The pioneers I have mentioned also developed an operating and advisory organization or line and staff with the proper division of functions, to fit our kind of business for many years to come, although at that time the volume was small. Thus, by 1890, the organization was in existence as we have it today, although the total number of telephones then in the United States was one-fifth of the number in New York City today.

This organization was ready to expand smoothly and effectively, that is, economically. There is no telling how much that readiness saved us, nor how it made possible the meeting of new demands for service.

The parent company, which is the American Telephone and Telegraph Company, gives a centralized administrative service to the operating companies associated with it, ties them together with its own long distance lines, maintains for all the associated companies the research and experimental departments, owns the manufacturing department (the Western Electric Company) and supervises the accounting and financial operations. This development was substantially according to the plan laid down by the utiltiy's founders, whose ideal even then was universal service.

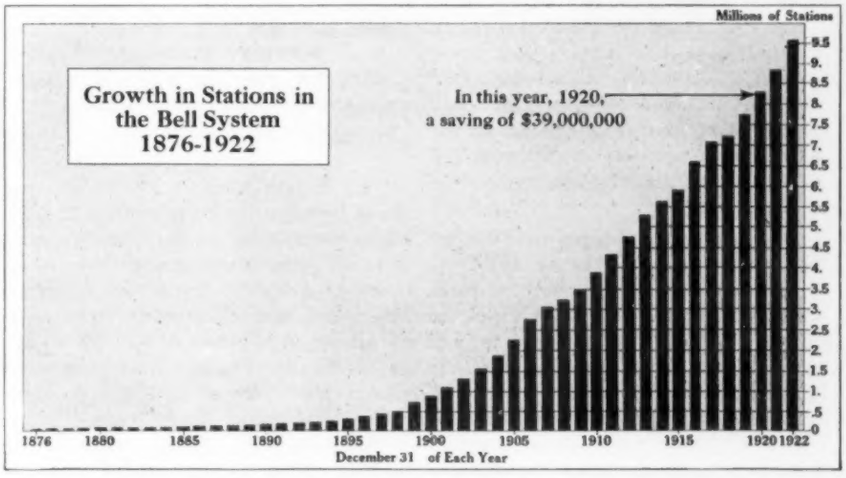
These pioneers surely looked ahead when they plotted their course. Their objective then was the same as ours today—the best possible telephone service, nation-wide and reaching practically any person, at the lowest possible cost. Today the service is nation-wide in its extent, with 14,000,000 interconnecting telephones, of which over 9,600,000 are Bell owned, with 240,000 men and women operating and maintaining the plant required to give it. What was hailed as a scientific toy has become an indispensable utility.

This plant though privately managed, is in a real sense publicly owned, for the stock of the parent company is in the hands of over 250,000 investors, one for every 38 telephones, with an average holding of 28 shares.

The management of such a service involves grave responsibilities, and none more fundamental than that of looking ahead. Today, indeed, it is our responsibility to look far ahead, even to the needs of the next generation.

We can never be content with our growth, our operating efficiency, our research and development achievements in advancing the art of communication both by wire and radio.

America already has one telephone for every eight inhabitants—by far the highest telephone development of any country, but the demand for new telephones shows no abatement. To keep pace with this ever-growing demand



Foresight that saved millions—Any plant, any business large or small, can save by preparing today for tomorrow's requirements. Perhaps this foresight is the only price at which safety from competitors can be bought. Mr. Thayer mentions that in one year in which the costs happened to be segregated, a certain bit of foresight—that works year in and year out for his company—saved $39,000,000

we are now adding at the rate of half a million telephones a year.

We must grow as the nation grows—but in advance.

Installations of these new telephones is a simple problem compared with the difficulties of having the rest of the necessary facilities ready that lie behind the visible telephone instrument. These can only be made ready by looking ahead. To avoid waste in construction, and couple maximum economy with maximum efficiency in rendering service, we must plan far in advance of the public's call. Land must be selected and bought, buildings designed and put up, switchboards and other complicated central-office equipment built and installed, cable manufactured and in place, personnel trained to the high point of skilled efficiency required to maintain America's standard of service.

The sort of thing every business must plan ahead for with foresight—Every business that has not set aside adequate reserves for contingencies is begging trouble. When these poles unexpectedly went down they went up again promptly, although a large cash outlay was involved. Their destruction was unexpected, but the unexpected itself was amply provided for—a fact that is easily substantiated if you care to notice under the heading "Reserve for Depreciation and Contingencies" the comfortable item of $68,515,833 on the last statement of the American Telephone and Telegraph Company

As a primary requisite, new capital in large amounts must be secured from investors with which to build the plant extensions indicated by a look into the future. This year the Bell System will spend approximately $200,000,000 to extend its facilities for giving service. Capital in such amounts could not be obtained if a reasonable return, together with an adequate margin of safety were not assured. That this extension of facilities need not halt for lack of capital is because the financial structure was built up after the most detailed forethought of the public's ever-growing reliance on the telephone, so that this return and this margin can be offered.

Foresight has an important bearing on keeping the plant in serviceable condition. Much of this plant is exposed to the elements in places where the population is not dense enough to warrant the cost of putting it under ground. Some storms are so severe that poles and wires over a wide area go down before them. One storm in New England last winter cost us $2,000,000. The cost of such storms to the public in the loss of time and money is enormous for every hour that the wires are down. And the cost of repairing would be much higher if it were not in some measure prepared for.

Planning Ahead to Minimize Delays in Service

We cannot forecast storms but we have foreseen their probability, and we have reserves of money and materials so that storm damage can be restored without delay. For the protection of the public in such times there must be a fundamental policy of looking ahead, as well as the traditional spirit of service in the men who fight and conquer the storm king.

We found out long ago that some of our forecasting problems are so complicated and important as to need survey experts, who are specialists in the science of determining the service demands of the future. But they mostly direct and assist the other employees to make the surveys. With the direction and assistance the work of looking ahead goes on far down the line of organization. Workers help to analyze the business phases of their own activities as related to the future need. Practically every employee above a certain grade is not only engaged in the accomplishment of the day's work but is looking ahead systematically. Their assistance has valuable results, for having taken part in the analysis, they understand it and are sure to make use of it. By aiding in making these studies that are always in progress, they get a new summary of their own activities which makes them ready to meet new responsibilities.

The responsibilities back of our plans are so grave that we ask the men and women of the organization to know and comprehend their full significance. We go to unusual lengths to explain to these workers our problems and our objective.

If we are not sailing true to the course we tell workers first of all, so that they will work the ship intelligently, not blindly. Thus they too are always looking ahead, because of their appreciation of the essential character of their work.

"There Must Be a Constant Check on Accomplishments and Objectives"

There must be a constant comparison between the records of accomplishment and the objectives that have been set up. We use current reports to

check up with long-term plans, to make sure that long-term plans are being gradually realized according to schedule, or that previous plans ought to be readjusted in view of new conditions. Such records of accomplishment are kept for every unit of operation, service, maintenance, and construction.

Charts analyzing all movements of the business are constantly studied by our executives; they are the topics of the conferences we hold so that widely scattered activities may be supervised and coordinated.

Thus division executives watch their districts, and are themselves supervised by the executives of our associated companies, and thus data are obtained that, when combined, enable the Bell System's position to be observed and checked with the main course that was laid down after looking ahead.

The growth of telephone service has not stopped. The company, big or little, must look ahead. We are studying the probable telephone needs for the next 5, 10, or 15 years. We are considering the new capital which will be required to meet the demanded growth. We have men studying the innumerable inventions and technical improvements without which we could not reach our objective of the best and broadest service which can be given at fair rates. We are looking ahead to the task of tomorrow.

Foresight is indeed so important in management that it is mingled with everything we do.

"The administration of an institution like the Bell Telephone System must be actuated by a continuous policy or motive," our directors' recent annual report said to stockholders, "and must make every line of action conform to a program directed towards carrying through that policy. Changes in times and conditions may properly affect the program, but the underlying policy must be constant.

"The policy of the company is to give a service broad in scope, good in quality and in every way satisfactory to the public. In our methods of carrying this policy into effect there are certain lines of action which have a bearing upon all phases of the undertaking.

"In all of these lines of action, foresight based upon studies of the facts of the past and present and intelligent estimates of the future has to be the basis of our program."

Illinois Convention at Peoria, November 13-15

Springfield, Ill. — Jefferson Hotel, Peoria, Ill., is to house the 1923 convention of the Illinois Telephone Association, November 13-15.

Financial Statement of Tri-State Company

The Tri-State Telephone & Telegraph Company, St. Paul, Minn., issued on September 1 checks in payment of the eighty-first quarterly dividend of one and one-half per cent (1½%) on the preferred stock of that company. The company has experienced a normal growth during the first six months of the present year, and has expended for extensions to its properties in excess of $350,000. Following its policy of keeping the properties in the highest state of maintenance, a great deal of time and money have been spent in improving the physical condition of the properties. The service rendered by this company is recognized as among the best in the industry. Its condensed Income Statement follows for the six months ending June 30, 1923:

Gross Earnings from all sources, $2,361,466.43.
Maintenance, Traffic, Commercial, General, and other expenses, $1,220,754.17.
Federal, State and Municipal Taxes, $130,866.53.
Reserved for depreciation of plant and equipment, $401,672.00.
Total, $1,753,292.70.
Net Earnings, prior to Interest, $608,173.73.
Interest paid and accrued, $149,032.90.
Net Earnings after Interest Charges, $459,140.83.

A condensed Balance Sheet showing financial condition of the company, June 30, follows:

ASSETS

Telephone plant, equipment, and supplies	$17,209,686.35
Stocks of system corporations	194,890.04
Due from subscribers, agents, etc.	274,957.91
Invested in marketable securities	352,435.18
Cash in banks	631,884.14
All other assets	90,160.47
	$18,754,014.09

LIABILITIES

Common and Preferred stocks	$10,118,580.00
Bonds (direct and assumed)	5,205,000.00
Accounts Payable (including accrued taxes and interest—not due)	397,161.10
Dividends on Common stock (Payable July 1, 1923)	180,760.00
Service billed in advance	56,863.68
Miscellaneous credits	5,337.27
Reserved for Employees' Benefit Fund	46,739.62
Reserved for renewal of physical properties	1,990,307.16
Other Reserves	15,322.80
Surplus and Undivided profits	737,942.46
	$18,754,014.09

Charles W. Weston, Port Byron, N. Y. Chief, Dies

Port Byron, N. Y.—Charles W. Weston, general manager of the Port Byron Telephone Co., died here August 6 after an illness of almost two years. Mr. Weston stuck to his job until a few weeks prior to his death. About sixteen years ago he started the utility which grew under his capable management to be one of the largest companies in Central New York. He was a prominent factor in local business and social organizations. His wife, daughter and son, C. Theodore Weston, assistant general manager of the Port Byron Co., survive him.

Wilson Lawrenson to Study Economic Conditions Abroad

New York, N. Y.—For the purpose of making an intensive study of economic and business conditions in Europe and Asia, covering a period of several months, F. A. Wilson-Lawrenson has resigned his executive positions with the Union Carbide and Carbon Corp. and its various subsidiaries, with which he has been connected since 1917. Too close application to his duties as vice-president in charge of sales for the Prest-O-Lite Co., the National Carbon Co., the American Eveready Wks., etc., has made it necessary for Mr. Lawrenson to conserve his health.

New British Book on Automatics

"Automatic Telephone Systems," by William Aitkin, Vol. II, Auxiliary Services and Private and Branch Exchanges. Published by Earnest Benn Limited, London, Price 35/ net.

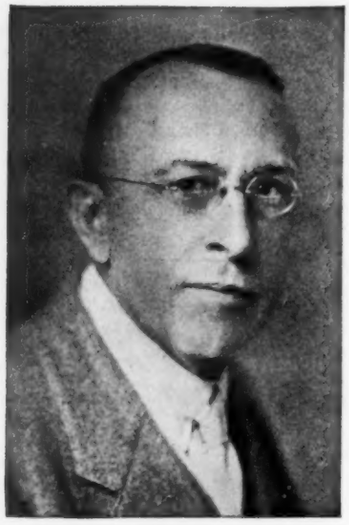
Volume I of this work which dealt with circuits and apparatus used in public exchanges appeared two years ago. It is one of the most valuable books on the automatic art, especially to the student who is not familiar with the general principles of the circuits and apparatus used. The author has taken great pains to re-draw and to simplify circuit drawings to eliminate the maze of crossing lines that mystify the novice. The analysis of circuit operations is made, step by step. To facilitate the tracing of the circuits, a certain symbol is assigned to each circuit and is used from end to end. This is of advantage even to the expert who can read the circuit at sight with practically no reference to the text.

Volume II, which has just appeared, deals with special circuits for the central office and for private and branch exchanges. Among the topics covered are: special service equipment for subscribers' stations, party line systems, small switchboards for PBX service, equipment for branch and private exchanges, and village and community automatic systems. The same general manner of treatment is used as in Volume I. The typographical work is excellent and the large size of page permits circuit drawings of a dimension that may be traced without undue eye strain.

It was originally planned to have the work complete in two volumes but the mass of matter is so great that a third volume is necessary. The next volume, it is announced, will treat automatic systems for large multi-office areas, semi-automatic systems, trunk and toll line working, power plants, traffic, etc.

London Orders Automatic

World's Largest City Places Initial Order for 50,000 Lines of Strowger Automatic Director Equipment—Triumph of Engineering Foresight



A. E. Keith, V.-P., charge of research and development, Automatic Electric Co.

Strowger automatic equipment will be installed by the British postoffice in the London area as a result of negotiations recently concluded by the Automatic Electric Co. and its foreign interests and the British telephone heads.

The London area's telephone system comprises more than 90 offices and is one of the largest in the world. Equipment to be installed is of the standard Strowger type, incorporating the Automatic Director recently developed by the engineering staffs of the Automatic Electric Co., Chicago, and the Automatic Telephone Mfg. Co., Ltd., Liverpool. The initial order calls for 50,000 lines of Strowger Automatic Director equipment in addition to equipment for a large tandem junction exchange which will form the nucleus for the conversion of the entire London network to automatic.

Arrangements for the installation of Strowger equipment began to crystallize early in 1922, when several representatives of the British postoffice visited the United States to study telephone conditions and inspected the Strowger Director equipment demonstration at the Automatic Electric Co.'s laboratory in Chicago. Later similar demonstration equipment was set up in London, where postoffice engineers have had it under observation and noted its performance under actual working conditions.

F. L. Baer, assistant chief engineer for the Automatic Electric Co., and E. A. Mellinger, director and special sales representative of the Automatic's foreign interests, demonstrated the adaptability of the Director system to the complex requirements of the London network in 1922.

When arrangements were concluded for the initial order during the recent London visit of A. F. Adams, chairman

T. G. Martin, Chief Engineer, Automatic Electric Co.

of the board of the Automatic Electric Co. and president of the Automatic's foreign companies, the Automatic's engineering staff attained a new record so far as the size of the field for its equipment was concerned.

Since Automatic's pioneer days the engineering force has been working toward the day of conversion of the largest cities to automatic equipment, so Automatic officials state, and the advent of the Automatic Director re-

Reading left to right—A. F. Bennett, Chief Engineer, Automatic Telephone Mfg. Co., Ltd.; F. L. Baer, Assistant Chief Engineer, Automatic Electric Co.; E. A. Mellinger, Director and Special Sales Representative, Automatic Telephone Mfg. Co., Ltd., and International Automatic Telephone Co., Ltd.

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moved the last obstacle to efficient and economical service of a highly satisfactory character in great metropolitan centers. Figuring as the leaders in the technical advance were A. E. Keith, vice-president in charge of research and development; T. G. Martin, chief engineer, and F. L. Baer, assistant chief engineer, all of the Automatic Electric Co., Chicago, and A. F. Bennett, chief engineer of the Automatic Telephone Mfg. Co., and E. A. Mellinger, director and special sales representative of the same company.

The Director System, which was specially designed to meet the traffic and trunking needs of large city networks, incorporates the principles by means of which the dial impulses are momentarily stored up and then sent out in different combinations.

Complete New Exchange Equipment for Rushville, Ill.

The Schuyler Telephone Co., Rushville, Ill., is making extensive improvements in its telephone system this year. The outside plant will be rebuilt to a large extent and the location of the central office changed to the company's building which provides adequate accommodations for a new switchboard equipment and general offices. The new central office equipment, cable and supplies were purchased of the Leich Electric Co., Genoa, Ill.

The exchange equipment consists of two two-position sections of Leich magneto multiple switchboard, ultimate capacity of 1080 lines with 700 lines equipped. The board has all features standard for the Leich magneto multiple switchboard, that is, full multiple, electrically restored line signals, operator's busy signals, line and cord pilots, with supervisory signals controlled by the operator's listening key. These features, especially the full multiple and electrically restored line signals, are termed of paramount importance, as they provide for distribution of calls to any idle operator. Thus it becomes unnecessary to have an operator in each position because of limited reach, any one operator having access to all calls on the board.

In addition to the switchboard, the company plans to install a new Cook main frame, consisting of eight verticals of framework and equipped with 100-type heat coil protectors. Work will be started at once. The Schuyler Telephone Co.'s improvements will put it in the front ranks of up-to-date plants and will strengthen the field of Independent operating companies. It has been proved that well equipped plants of this kind prove profitable investments and assure retention of control in local hands.

Monarch Making New C. B. Telephones

Chicago, Ill.—After considerable research and experimental work the Monarch Telephone Mfg. Co. has brought to the market new models of wall and desk common battery telephones. Among the improvements in the equipment, as noted in the excellent bulletin recently issued on the products, are the following:

A new and pleasing method of mounting the transmitter assembly. The transmitter is fastened to the back by bayonet slots and set screws. The back itself is fastened to the phosphor bronze mounting neck by a concealed hinge, having the appearance of a ball and socket joint, but permitting vertical motion only.

The hinge referred to is concealed in the transmitter back, but is accessible by removing the transmitter itself. While the transmitter can be easily moved, the adjustment is such that it cannot fall of its own weight, but is held firmly in any position desired. The design of the hinge is such that what little wear there is is automatically taken up, making the adjustment entirely permanent.

The entire transmitter assembly or any part of it is interchangeable with that of the wall set.

Several distinct improvements have been made in this receiver, improving its service and enabling it to withstand the most severe usage.

The receiver hook and the spring assembly, which are interchangeable with those of the wall set, are mounted on a plate which extends from the mounting neck to the desk stand base. By loosening the single "non-losable" screw holding the base plate and backing up the screw above the hook, the transmitter assembly may be lifted about four inches, withdrawing the spring and hook assembly for inspection. The springs are of high grade phosphor bronze.

The Base Assembly

The tube and base are constructed of heavy steel rigidly fastened together, the entire assembly being parkerized and japanned. The base contains a heavy micarta terminal block plainly marked for the various connections. Terminals are of brass and designed so that a positive and permanent connection is assured. The wiring is in cable form, color-coded and with a "loop," so the terminal block may be removed from the base.

The ringer is entirely enclosed and is mounted gongs downward. The bottom of the ringer box is perforated with "radiator" slots. The gongs are drilled off center to permit easy adjustment, and the ends of the gong posts are knurled to hold the gongs firmly.

One of the most valuable features of the new Monarch common battery telephones is the interchangeability of their parts. The receiver, transmitter and transmitter assembly, as well as the hookswitch and group of springs of the wall set, are each identical with the corresponding parts on the desk telephone and interchangeable with them.

The cover of the wall telephone may be locked when closed by a tongued spring riveted to the side of the cover. By turning the screw in slightly the tongue engages a slot in the base. The same locking device is used on the ringer box.

When the cover is opened all terminals, parts and wiring are in full view and easily accessible for any changes or replacements. The terminals and wiring are designed so that any changes in circuit may be made without disturbing the interior connections.

New Monarch common battery telephones